

E-Toronto

Building a digital society

By

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A thesis presented to OCAD University in partial fulfillment of the requirements for the degree of Master of Design in Digital Futures

Toronto, Ontario, Canada, 2022



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Keywords: Human centred design, data control, open data, data privacy, data-driven participation, future of cities, smart cities, design thinking, data engagement, speculative design, user experience, interface design.

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Abstract

With the rise of smart city projects around the world, we begin to question “What is a Smart City”? With many smart city initiatives being led by tech giants with corporate agendas, projects often fail to launch. With a focus on big data-driven strategies, these initiatives take on more of a technocratic approach. As a result, these projects often look at citizens as sensors and fail to prioritize the value that people bring to the process of urban development. With data proving to play a key role in the process of decision making, researchers question who has the right to data? And with citizens playing a pivotal role in the process of data collection, how can its value also be shared with those who generate it?

Through a speculative and critical design approach, this paper explores the question, “What if the citizens of Toronto could begin to control and engage with their data?” Beyond addressing major issues around data privacy, how could the city encourage data-driven participation under open data initiatives? By imagining E-Toronto, a smart city initiative that is citizen centric, this thesis explores how data can become public infrastructure to support urban development and create new and more contextual experiences for citizens.

Acknowledgements

Thank you to my Primary Advisor, Adam Tindale, for always being positive and motivating me through the entire process of this thesis. His encouragement and advice helped me navigate through the difficult portions and most importantly helped me grow beyond my research. To Nicholas Puckett, my secondary advisor, who helped me incorporate a broader lens through the initial phases of this thesis. And to Professors Emma Westecott and Cindy Poremba for their constant guidance, facilitation and support throughout this project.

I am very grateful to my OCAD community of friends and classmates, whose feedback and moral support brought different, rich perspectives to my thinking. I will miss the laughter and groups chats that made this program memorable.

And lastly, I would like to thank my partner Mallika for all her persistent energy and support through this project.

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Glossary of terms

The glossary of terms consists of 2 sections. The first section includes established terms used throughout the paper, while the second section includes the definitions of terms in context to the subject of the paper.

Section 1: Established terminologies

Contextual experiences: A contextualized experience is a tailored, adaptive, and sometimes predictive customer experience that combines and extend existing segmentation and personalization techniques with in-the-moment details. The main purpose of contextualized experiences can be simplified as maximizing relevance to the user (One 2022).

Data point: A data point is a discrete unit of information. Any single fact could portray a data point. In a statistical or analytical context, a data point is usually derived from a measurement or context and can be represented numerically and/or geographically (Wigmore 2012).

De-identify data: Data that has separated any personal identifiable information at source before it is finally transferred to be analyzed and used (Ann Cavoukian 2011).

Data visualization: Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data (Tableau 2003).

Human centered design: A creative approach to problem-solving that starts with people and ends with innovative solutions that are tailor-made to suit their needs (Testing 2022).

Information and Communication Technologies (ICT): A broader term for information technology, which refers to all communication technologies including the internet, wireless networks, cell phones, computers and other media applications and services that enable users to access, retrieve, store, transmit and manipulate information in a digital form (Pratt 2019).

Internet of things (IoT): A system of interrelated computing devices connected over the internet that can transfer data over a network with requiring human-to-human computer interaction (Meola 2022).

Open data initiative: An initiative that promotes the practice of open data and offers faster and easier access to data through a single portal. This also supports government efficiency, public engagement & participation, and innovation (Commissioner 2009).

Privacy by design: With the ever growing and systemic effects of ICT's, privacy by design is a concept that states that organizations must consider privacy concerns while performing data processing practices (Ann Cavoukian 2011).

Smart city: A city that leverages technology and data purposefully in an urban environment to be better informed and make better decisions to deliver a better quality of life (Jonathan Woetzel, Jaana Remes, Brodie Boland, Katrina Lv, Suveer Sinha, Gernot Strube, John Means, Jonathan Law, Andres Cadena, and Valerie von der Tann 2018).

Speculative design: A design method that leverages imagination and aims to open new perspectives on what we refer to as wicked problems. The use of such a method is to encourage a space for discussion and debate (Anthony Dunne, Fiona Raby 2013).

Volunteered geographic information (VGI): This is the use of digital tools to

collect, analyze and share geographic information that is voluntarily shared by individuals (Colin J. Ferster, Trisalyn Nelson, Colin Robertson, Rob Feick 2018).

Section 2: Contextual definitions

Context: A background, environment, setting, framework or surroundings to an event or occurrence. Simply, context means circumstances forming a background of an event, idea, or statement in such a way as to enable readers to understand a narrative or situation better.

Contextual development: Developments that are informed and made in response to the needs and contexts of citizens.

Data decolonization: The decolonization of data is a process of involving communities in the collecting, sharing, and analyzing of data. This includes deciding what data is collected, how it is collected and how it can be shared with the broader community for their benefit.

Data-driven participation: Data is used to support decisions, policies and actions as evidence-based choice making. Data- driven participation is the engagement of the public in the process of gathering and reflecting data to make local decision making an inclusive process.

Open data: Data that is structured and openly available to freely be shared, used, and built upon without any restrictions.

Digital rights: Human rights extend into the digital sphere. These are human rights in both physically constructed spaces such as infrastructure and devices, as well as virtually constructed spaces that interact with online identities.

Technocratic: The adoption of a practice that offers experts on science or technology political power and influence to make big data-driven decisions.



1.0

Introduction

1.1 Context

With the world's population now nearing between 3 to 4 billion people residing in cities, never in human history has the Earth supported hundreds of millions of people in such dense settlements. Over the past decade, the terrain of cities has evolved and spread, but unlike their ancestors, current urban environments are closely knit together into a single digital mesh of movement and exchange (Greenfield 2013). With the development of Information and Communication Technologies (ICT) that encompass all communication technologies, including the internet, wireless networks, cell phones, computers, software and other media applications and services, people began to interact and communicate over a digital medium. With such an evolved grid of networked information technologies we could collect, process, and evaluate decisions made by people in various contexts in the form of data. Data that could be leveraged for urban development to improve the quality of life, offer better services, and reduce the environmental footprint and improve sustainability (M. Batty, K.W. Axhausen, F. Giannotti, A. Pozdnoukhov, A. Bazzani, M. Wachowicz, G. Ouzounis, and Y. Portugali 2012).

The development of ICTs not only catapulted our digital growth but also planted the vision of Smart Cities: cities that could leverage technology and data purposefully through interactions in an urban environment to be better informed and make better decisions to deliver a better quality of life for its citizens (Jonathan Woetzel, Jaana Remes, Brodie Boland, Katrina Lv, Suveer Sinha, Gernot Strube, John Means, Jonathan Law, Andres Cadena, and Valerie von der Tann 2018). Benjamin Bratton proposes that genres of computation like smart grids, cloud platforms, mobile apps and the Internet of Things should not be seen as multiple fields evolving on their own but rather forming a coherent whole: an accidental megastructure called The Stack (H.Bratton 2015). Like The Stack, smart city projects aim at developing a grid of networked information technologies that can record and understand more about the needs of citizens.

While ICTs have brought the world closer together, it also raises concerns around digital privacy and divides. With data becoming a new form of currency and value, companies sought out data for their personal ambitions. As more stakeholders ventured into the digital world, the benefits of data slowly shifted away from people and towards companies with capitalistic agendas. The sole objective of gathering data became for the use of decision makers and began to warp the meaning of democracy (Greenfield 2013). After all, the very meaning of democracy is that each one of us in our own lives are solely the decision makers with the responsibility of shaping urban life. These values of the digital world led to further divide between stakeholders serving the same user, while also exploiting them for their data.

This influenced the vision of a smart city to a thoroughly technocratic one, with its goal being the computational extraction of value from everyday activities. Value that would not only be extracted & preserved for a very small minority, but also value that would not be shared with those that generated it. While many smart city visionaries speak about data-driven urbanism or networked cities, Adam Greenfield in his book 'Against a Smart City' raises an important question on the provenance of data. He further explains that there is no concept of raw data and that all data come from somewhere or someone. Author Lisa Gitelman also agrees with this perspective and quotes "Raw Data is both an oxymoron and a bad idea" (Gitelman 2013). She goes on to iterate that at some levels, the collection and management of data may be said to presuppose interpretation. With data already cooked within the varied circumstances of their collection, storage, and transmission, we sometimes find ourselves in situations where data is referred to as "raw". And so, with regards to that, we need to ask ourselves, who made the data? Who gathered it? How can we as citizens gain access to it? And what can we do with it at a community and personal level?

Through this thesis, I explore a smart city initiative for Toronto and the role that citizens could play in its development while identifying the values that

support more meaningful access and ownership of people's data. Through the thesis, I explore ideas on introducing data as a public infrastructure and officially onboard citizens to the world of data and its capabilities. To do this, I propose a city-led smart city initiative called E-Toronto.

1.2 Purpose

The purpose of this thesis is to highlight the importance and capabilities of data and to explore ways to reimagine how data can serve our communities in day-to-day activities. E-Toronto will also showcase the potential of an open data network, while prioritizing transparency and control for users. As transparency and control take precedence, the thesis explores how citizen engagement can improve, and how the dialogue between people and the government is strengthened. Finally, the thesis looks at how an open data network can encourage data-driven participation and begin to acquire user generated feedback in a direct and accessible way to support the city's urban developments.

1.3 Objective

This research aims to achieve the following objectives:

- Understand the different values and goals that contribute to the development of smart cities
- Identity the drawbacks and opportunities in current smart city initiatives around the world
- Design a potential digital touchpoint via the E-Toronto mobile application for the citizens of Toronto to acquire meaningful contextual experiences with the city's open data network while providing them with control and a digital identity
- To develop a prototype that could support the next phase of the thesis. The prototype will help trigger conversations with individuals, businesses, and governments on how data can be managed and used in the future



2.0

Research question

By treating data as public infrastructure, how can the city of Toronto understand the capabilities of open data, encourage data driven participation and provide greater transparency & control to its citizens?

Public infrastructure: With the development of ICTs, data has become a hidden commodity that affects our lives. Treating data like water and energy, this thesis explores how the value of data can become accessible to all.

City of Toronto: The goal of this research is to speculate a new initiative that can be piloted in Toronto before potentially moving to other Canadian cities.

Open data: In the absence of open data, citizens cannot engage with data. Furthermore, data that is openly shared but that cannot be engaged with can also be considered absent. The relevance and capabilities of data not only depend on its openness, but also how consumable it is.

Data-driven participation: This relates to the idea of citizens generating data and contributing to the open data network, which engages citizens in the process of decision making and urban development.



3.0 
Literature review

3.1 Smart Cities

3.1.1 What is a Smart City?

The idea of building smart cities came from providing citizens with a better way of life. While the term “better” may have multiple implications, the commonly agreed upon objective between citizens and companies is how data can be leveraged to identify fragile parts of a system and help improve on them. With several smart city projects globally taking off the ground, we can begin to see how different terminologies are being used while defining similar objectives and solutions (Dameri 2013). Terminology like wired city, intelligent city, digital city, techno city and so on, each with a different objective towards a focused domain.

In the absence of a consistent vision, the definition of a smart city has taken on more of a general technocratic meaning. Thus, a smart city is defined as one that leverages information and communication technologies (ICT) to improve operational efficiency and address growing urbanization challenges.

Looking back and raising the important question of provenance (Greenfield 2013), many proposed smart city visions often ignore the key quality of the city, which is its people. The author further goes on to explain that implementing smart city initiatives do not only mean reaching technological success, but also using technology to bring value to the public (Dameri 2013). With that being the focus, the authors literature surveys also highlight encouraging researchers that popularly define smart cities as well-performing cities built on smart foundations and activities of self-decisive, independent, and aware citizens.

3.1.2 What have we learned?

Projects that ignored the interests of citizens and dismissed their roles in the

development of smart cities, often lacked the right principles to take off. Take the example of the Toronto Harbourfront Project by Sidewalk Labs, a New York-based urban innovation company. The primary strategy assumed by Sidewalk Labs was one that valued the capabilities of technology more than that of citizens residing in the city. With designs that incorporated multiple smart cameras, sensors and other data collection technologies, the project aimed at constantly collecting data on users without their consent (Forum 2021). The project introduced heavy surveillance that would record and analyze data for better urban planning. The Information and Privacy Commissioner of Ontario at the time, Dr. Ann Cavoukian, raised questions on the privacy of citizens and aimed to protect them at the early stages of the project. She suggested that privacy by design needed to be incorporated in all operations of the project and that de-identifying data at source would be the right values to follow moving forward with the project. The de-identification of data meant stripping the data of any personal identifiers before it was finally transferred for analysis and use. She further reiterates that with the concern of privacy at an all-time high of 90% and 92% of concerns on the loss of control over their personal information, it was important to begin this new chapter on the right note. With the agenda of the company steering more towards its technological capabilities and developments, it failed to adhere to the privacy by design agenda set by Dr.Cavoukian. She highlights that the biggest privacy and ethical concerns with smart city projects is that companies do not want to adopt the concept of privacy (Forum 2021). With more insight into a user's life, companies receive a deeper hook to capture a user's attention and prolong the use of their service, which leads to more interactions and therefore the collection of more data. This technocratic focus adopted by Sidewalk Labs also created another big problem for the project, which is the lack of engagement with the public. With a layer of interaction missing, the project lacked a critical understanding of what the public wanted, what kind of technology was needed and most importantly a deeper understanding into how to engage them.

3.1.3 Citizens for cities.

Matti Siemiatycki, Professor of Geography and Planning and Director of the Infrastructure Institute, University of Toronto, also speaks about how city building, and urbanization should be an active “local” exercise. With a smart city project intervening in existing environments, it’s crucial to embody a detailed understanding of the local environment (Forum 2021). Siemiatycki also points out that one could reflect on Sidewalk Labs’ approach to the project just through their marketing. He quotes “Sidewalks Labs called it Building A City From The Internet Up. That doesn’t evoke good urban planning that we are going to integrate technology into, in fact, it is the complete opposite.” A technocratic approach like this would only lead to technology driving how the city should be built. He calls attention to how people of the city don’t want to be living in a city where technology is dominating. Rather than people optimizing to technology, technology should be optimized to people. Alternatively, he also underlines that there are currently many aspects of the city that are smart but not technology driven. For instance, being walkable, having bike lanes, and having planned areas with mixed uses that are distributed evenly.

Both Dr. Ann Cavoukian and Matti Siemiatycki believe that the development of smart cities are inevitable. But what we can control is the set of principles and values that we practice through the journey. With the role of communities and people front and centre, people’s privacy can be protected. And through citizen participation and transparency, people can constantly engage so that technology is always at the service of people, rather than the other way around.

3.1.4 Promising signs

Estonia’s recent efforts have set the perfect example for the development of smart cities. The country’s smart city project was a collaboration model between the Tallinn city government and the Tallinn University of Technology (Lill

Sarv, Kristel Kibus, Ralf-Martin Soe 2020). With the collapse of the Soviet Union and its independence in 1991, the city received a clean slate right in time for the Dot-Com Bubble. Despite this advantage, the city's challenge was to enhance smart city initiatives with finite resources and finances. Observing the difficulties that other countries faced with their smart initiatives, the project closely documented its learnings. Another advantage between the partnership of two public institutions was the absence of any capitalistic agendas. This helped avoid any technocratic visions and even resulted in both institutions sharing similar ethical or public values, which made negotiations of contracts and setting goals easier (Lill Sarv, Kristel Kibus, Ralf-Martin Soe 2020). Their strategy showcased a consideration of many stakeholders, which included the involvement of local communities as partners or even associated partners of the project.

Having adopted a user first approach, the project began with understanding the importance of a digital identity and how that would play a vital role in binding all e-services that the smart city would offer. With an e-identity, the need to be physically present to complete a task was proven obsolete. The e-identity also anchored a point at which every citizen would be onboarded to the system. Once onboard, citizens were gradually introduced to a variety of e-services. And over time, the level of digital literacy slowly increased and became a normal way of life. Embracing a user centric strategy so early on, 97% of all schools were online by 1997 and the government had constructed a free Wi-Fi network in all inhabited areas by 2002. From 2007, it was possible to vote digitally, and by 2017 the average Estonian took only 3 minutes to complete their tax declarations. All this is facilitated by the safest, most privacy-friendly system ever built by a government (Arets 2017).

A key factor to the success of this government was its partnership with a university instead of a consulting firm. This benefitted the project with a mutual collaboration towards the positive impact on local socio-technological challenges. This collaboration towards the positive impact on local socio-technological

challenges. This collaborative model towards smart city initiatives eradicated any glimpse of a digital divide and helped focus on the interest of its citizens first. In its early stages of development, the city of Tallinn experienced a successful smart city initiative, which only proved to initiate a chain reaction of smart city projects (Lill Sarv, Kristel Kibus, Ralf-Martin Soe 2020), all leading towards a cohesive smart city strategy and vision.

3.2 The Role of data

3.2.1 Open data

Over the past decade, we have developed a broad and deep understanding of the value data brings into our world. With tech giants dominating the space of data collection and analysis, we begin to rethink our approach towards the right over data and reimagine how its value can be shared with those who generated it (Greenfield 2013).

As researchers and specialists explore the various potentials of an open data system, we are beginning to see a promising new emerging class of smart city initiatives that have grown from traditional sustainability-related objectives to ones that include open data initiatives.

And so, what is open data? It is the idea of openly sharing data to a public forum so that it can instantly be available for everyone to use and leverage. Like prior open-source movements such as open-source software or hardware, open data is an initiative to encourage sharing knowledge and improve transparency to empower citizens and promote innovation (Adegboyega Ojo, Edward Curry, Fatemeh Ahmadi Zeleti 2015). Open data programs also have the effect of allowing other entities, such as NGOs and the private sector, to access valuable government data, which could then be used to generate alternate services for

city residents (Peter A. Johnson, Albert Acedo, Pamela J. Robinson 2020). Relying on secondary information published online, the authors identify smart cities around the world that strongly promote open data initiatives as smart city initiatives. Greater Manchester Datastore, Manchester City has created a platform that makes public data open and accessible to the developer community. With access to this data, multiple applications were created to help the city function better. Another proposal by the Transport for Greater Manchester aimed to release bus time data of the city to interest organizations working on building applications that help people find travel information better. And lastly an example of Park Shark Connect developers from Amsterdam city sharing parking data that helped Amsterdam drivers find parking spaces more conveniently.

These open data initiatives also enable governments to improve upon collaboration, participation, communication, data exchange and the integration of all their services. In the area of collaboration, open data encouraged the collaboration between stakeholders in identifying common needs. In the area of participation, open data encourages the participation of developer and residents in sharing ideas and building new services. In the area of communication, open data enables better policy outcomes. In the area of data exchange, it stimulates the sharing of data between all stakeholder of the city, including those from the infrastructure providers and the city management. And lastly in the area of integration, open data motivates the creation of new software development tools to broaden the practice of open data. Through such cases, it is evidently clear on the positive impacts of open data initiatives. A common string between all these cases was the sharing of data between the government, developers, and other organizations.

While a transparent and open system do highlight its potential, it also presents equal concerns. Namely, a key concern of adequate security in the system and its balance with openness. In order to envision a secure open data initiative, it is important to empower all stakeholders of the system while the

primary focus is on citizens.

Although Toronto currently has an open data initiative within the city's official website, the uploaded data lacks engagement and is organized in the forms of reports and spreadsheets. While these formats work for professionals and data analysts, the value and experience of that data is lost with the average citizen. Most initiatives find themselves in a similar situation as their approach to open data includes sharing it online and stating that it is free for all. But for citizens to truly gain its value, the data must be presented through an accessible and engaging experience; one that still focuses on protecting privacy and encourages active participation.

3.2.2 Data-driven participation

But what if the conversation of data became one that was regular amongst citizens (non-developers or creators)? With the world of technology evolving quickly and the nature of a city and its citizens' needs everchanging, what if citizens could personally benefit from their own data? With people generating millions of data points everyday through their digital interactions, what if those very data points could be understood and voluntarily shared to the city to better serve the evolving needs and interest of its citizens? With data flowing through every decision, action or transaction made by people, data-driven participation is the key to empowering citizens and influencing government decision-making. Here's an example of how just one user generated data point allows people to play a more active role in developing the space around them.

The authors (Matthew Tenney, Renee Sieber 2016) consider the capabilities of big geographic data called Volunteered Geographic Information (VGI). VGI is the harnessing of tools to capture, record and analyze geographic data that is voluntarily provided by users. They highlight that leveraging VGI can increase

participation due to the ease of engagement and by treating “citizens as sensors”, it can improve the quality of data collected. Through the use of improved internet technologies, the use of VGI claims that government decision-making can be made more transparent, and the democratic process can be extended to everyone. Present in the spatial use for users and a voluntary habit of sharing data, VGI has been situated as a technological solution to the “messiness of democracy” (Matthew Tenney, Renee Sieber 2016). With citizens openly sharing data, the public is actively involved in the governing process and justifies a government’s decision. The reason for VGI not playing a transparent role in urbanization is because of its top-down approach inspired by the motivations of the corporate world, with technology at the top and the interest of citizens below. The use of VGI enables users to contribute their own data. One that is not altered by existing experts. Experts shift from being primary data producers to passive users that are part of the system. As we know of it today, VGI presents itself as easy-to-use technology that enhances the interactions between citizens and facilitates a direct connection between citizens and governments. The ultimate goal is to identify more methods of such data collection practices that would eventually lead to an automated democracy.

3.2.3 Data analysis, planning and governance.

The example of VGI also presents an authentic process of not only data collection but also its analysis. The evident problem with data collection and privacy today is first, the obstruction of one’s privacy while collecting data, followed by the biases applied while analysing that very data. On recognising this pain point, governments now question the need for adapting more of their operations to a form of algorithmic governance. But while the government still debates this, the use of data-driven techniques also brings unparalleled advantages to governing. Advantages like solutions that have a deep understanding of a community’s needs, providing real-time metrics while determining outcomes,

using unbiased algorithms which can accommodate real time data and adjust in cases of new scenarios and lastly a systematic method that present constant scope to be upgraded and improved. Data-driven techniques powered by algorithmic procedures may act as a corrective lens towards our digitally divided world.

Due to the digital divide, Toronto's Harbourfront Project experienced yet another failure in its attempt to drive data-driven participation through a smart city initiative. The Intelligent Community initiative was a hybrid system operated by a private company called Element Blue LLC. As a global partner to IBM, the company provides software solutions to government operations. They aimed to introduce their flagship software called CitizenReach. A public-enabled web, mobile and tablet platform that facilitated dialogue between citizens and governments. The platform would consist of features that let citizens voice their concerns and opinions. The goal of the project was to integrate this platform into Toronto's Harbourfront community. The smart city initiative was called the New Blue Edge project. Despite the launch of the project in 2014, residents of the community are yet to hear anything about its services. From the get-go of the project, many citizens and planning officials were out of the loop and a major portion of the project was taken under corporate control. Several years passed and with \$1.2B of public investment in the project, it still seems to be in its developmental phase. Many assumed that it was a corporate strategy to get users to download an unfinished application that would begin to harvest users' data. The New Blue Edge project stands in the recurring theme of smart city initiatives that failed due to lack of control by citizens and the government over the data participation efforts. These very actions presented a lack of transparency, privacy, and empowerment. Such initiatives widely present companies with the opportunity to access existing public resources and fuel their goals to resell such valuable data to others with such interests.

To purely practice data-driven participation, the "how" and "what" behind

proprietary black boxes need to be exposed (Matthew Tenney, Renee Sieber 2016). In doing so we can present strong promises of transparency and clearly define the role of who gains control and responsibility of the data and its outcomes. As Dr. Ann Cavoukian earlier proposed, that transparency and privacy must be incorporated in our networked data systems and technologies (Ann Cavoukian 2011). She further implies the importance of privacy and how it must be embedded into every standard, protocol, and process that have the ability to influence our lives. Through extensive research that highlights the drawbacks of corporate dominance, I believe that her principles on privacy by design must be extended to issues on transparency and data participation. Her privacy by design practice constitutes 7 foundational principles:

1. Proactive not Reactive; Preventative not Remedial

Privacy by design as an approach must be characterized as a proactive than reactive approach. Its primary objective is to prevent private risks rather reacting once they have happened.

2. Privacy as the Default Setting

A proactive approach must reflect itself throughout the system. Rather than features being opted in by default opt in, we must begin with offering the user the option to opt in. If an individual does nothing, we must treat that situation as their decision. No action is required on the part of the individual to protect their privacy (Ann Cavoukian 2011).

3. Privacy Embedded into Design

Privacy needs to be integral to the system, without diminishing functionality. As a result, privacy is an essential component of the core functionality being offered.

4. Full Functionality-Positive-Sum, not Zero-Sum

In order to build privacy into the system we need to accommodate all legitimate interests and objective in a positive-sum "win-win" situation and not through a

zero-sum approach, where we often feel a compromise has been made.

5. End to End Security- Full Lifecycle Protection

The proposition of such a system does have its responsibilities like any other. The process must ensure that all data is securely handled through all stages. This includes even the destruction of data at the end of a process.

6. Visibility and Transparency- Keep it Open

This principle seeks to assure all stakeholders that all operations are in accordance with the stated promises and objectives.

7. Respect the User Privacy- Keep it User-Centric above all

Keeping the interest of user is most crucial. By offering strong privacy defaults, appropriate updates and user-friendly options, all design aim to offer user centric experiences.

Through her foundation for the Principle of Privacy by Design, each principle specifically addresses how data and information should be collected and constantly been made transparent (Ann Cavoukian 2011).

3.3 Citizen engagement & experience

3.3.1 How do we engage citizens?

With the focus of the thesis on the residents of Canada, it was promising to find that the government was inclined to take smart approaches to citizen engagement for the development of the city. The government's initial research emphasized that the process of planning can be equally important to planning the outcomes of the project.

The success of data-driven participation hinges completely on the strategy being employed to engage citizens (Peter A. Johnson, Albert Acedo, Pamela J. Robinson 2020). Over the past, citizens were either consulted, invited to participate, or even deeply engaged. But knowing the difference between the 3, might just define the success of the approach. The difference being that engaging citizens in a deeper form of participation presents them as co-creators, while the other 2 approaches lack a sense of involvement. Decisions on city planning and urbanization always required physical attendance and so citizens display a sense of comfort to those traditional methods. These conditions do present time and location constraints. But one might suggest that in our day and age, the instant solution to such problems is technology. But that stands to threaten to move or bring change to old ways of citizen-government participations. Many believe that with the complete integration of technology, traditional methods of engagement will be considered as hollow transactions.

In their paper, "Type, Tweet, Tap, and Pass: How smart city technology is creating a transactional citizen", the authors defined four types of transactions for citizen engagement in a smart city (Peter Allan Johnson, Pamela J Robinson, Simone Philpot 2019). The first is "type", representing an unrequested citizen to government transaction, such as an email. Second is "tweet", an alternate term for engagement through social media platforms. Third is "tap", as governments search for citizen opinions and feedback on specific and focused topics. And lastly "pass", referring to feedback received from city cameras, sensors, or any other form of surveillance. These forms of engagements are defined as transactional. Through this work, the authors explore which methods of engagement do the residents of Canada currently prefer (Peter A. Johnson, Albert Acedo, Pamela J. Robinson 2020). The government of Canada in 2017 launched the SSC, a smart city innovation challenge. All communities were encouraged to participate by selecting an important issue and handing in a proposal. The top three proposals received prize money that would be donated to their communities. The challenge began with over 200 proposals, from which

130 qualified. The report compared and documented different citizen engagement activities adopted by communities while building their proposals. The engagements ranged from traditional to transactional methods. On categorizing them, 74% of all engagement activities represented traditional engagement methods like workshops, focus groups and interviews. Methods which convened a two-way active dialogue between the government and the citizens of the city. While this comes as a surprise, each applicant city brought a unique perspective on the kind of engagement based on whether the city currently had smart city initiatives or may be considering what a smart city is to them for the very first time.

Though a minority of proposals did use more transactional methods of engagements, they lacked a variety of different types of transactional categories or style of engagements. A modern solution to this approach would adopt transactional methods due to the higher volumes of feedback. But what the Smart City Challenge highlights is that maybe future forms of engagement should consider how multiple engagement activities come together, with a combination of both types of engagements activities coming together as part of a larger strategy.

3.3.2 How can citizens benefit? And what would those experiences look like?

Drawing inspiration from smart city initiatives with open data values and citizen centric approaches, my thesis project speculates a smart city initiative for the city of Toronto. The initiative aims to explore methods of actively engaging citizens and weaving in the narrative of data as public infrastructure and open data. The thesis looks to integrate technology and design while still preserving traditional methods of public engagement. By involving citizens into the broader conversations and impacts of data, the thesis looks to design an application that helps citizens gain ownership of their data and be a part of their communities' development.



4.0

Methodologies

4.1 Speculative design method

The objective of my research is to suggest an open data initiative that considers data as public infrastructure, encourages citizen participation and offers control over their data. With the growth of the internet, privacy remains an unaddressed issue, making it a more prevalent social concern. As Dunne and Raby discuss in their book, "Speculative Everything", speculative designs can be used to "debate potential ethical, cultural, social and political implications. (Dunne and Raby 2013)". More specifically, speculative design can be defined as a design method that addresses societal issues while looking towards the future and creating specific products and services that are suitable for those scenarios (Tran 2019). Because we have to reimagine the constraints that today's world imposes, speculative design is an ideal method to use to imagine an alternative reality. Below, I use a speculative thinking framework to organize my approach to this topic.

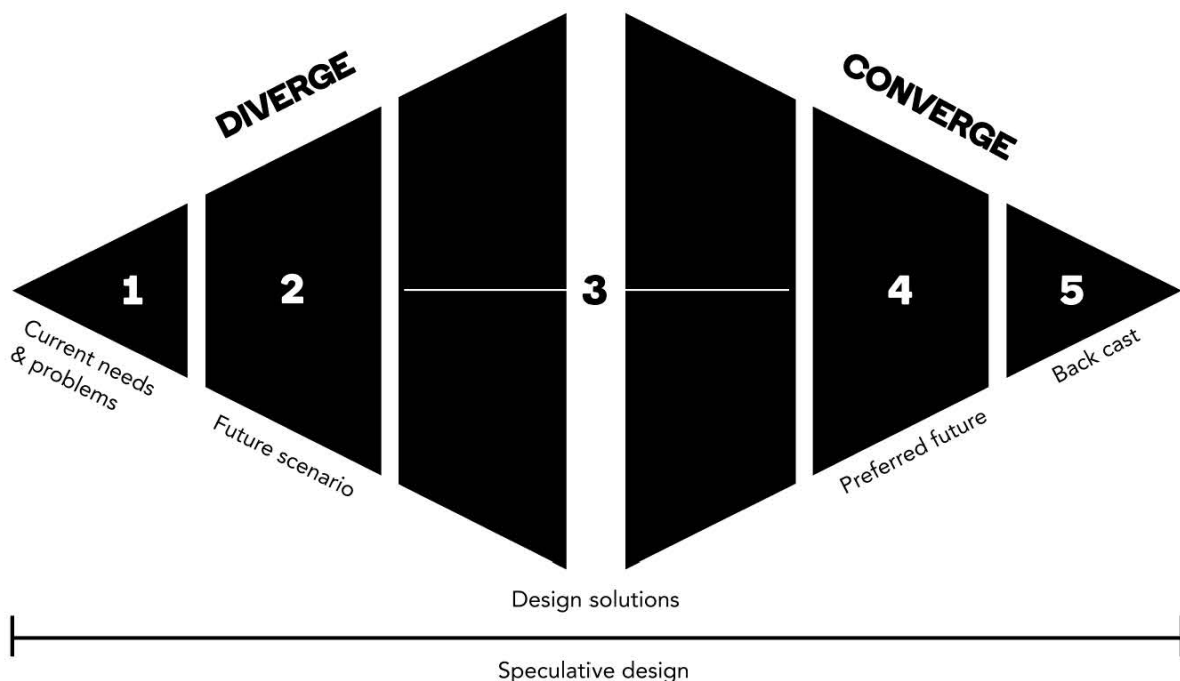


Fig 1: Speculative design framework

This framework was inspired by Damien Lutz (Lutz 2020). It begins with divergent thinking, as I evaluate the present day needs and problems. I cover this through exploring secondary research on smart cities through the Literature Review section above. I then consider the ways in which these current needs and problems can be resolved in future scenarios, and what those may look like. In the Project section, my learnings are applied to design solutions which start broad in order to tackle these various problems, until they start getting more focused and enter the convergent phase. In this phase, the design solution seeks to solve a narrower problem that I dive deeper into as a preferred future for Toronto. Finally, in the back casting phase, I ideate how this preferred future can be realized using a combination of considerations for infrastructure, teams and policies.

4.1.1 Diverge

I begin the Diverge segment via the Literature Review section that focuses on understanding the approaches and outcomes of current smart city initiatives. I learnt that as the potential of technology has expanded, our perspective towards collecting and sharing knowledge has changed. With the capabilities of technology to capture moments, record decisions and understand context better, data takes the form of currency in a digital economy: a commodity of trade that often includes unethical ways of collecting, analysing and sharing data. Data as a commodity triggered many technocratic visions that led to unsuccessful smart city initiatives as discussed in the early segments of this paper. Attached to the belief that "Knowledge is Power", the system prioritized corporate agendas over a citizen-centric approach (Chafetz 2021). This led to a knowledge economy where people lost their privacy and control and were exploited for their data as long as they were in need of a product or service, constituting a current problem.

Knowledge is power

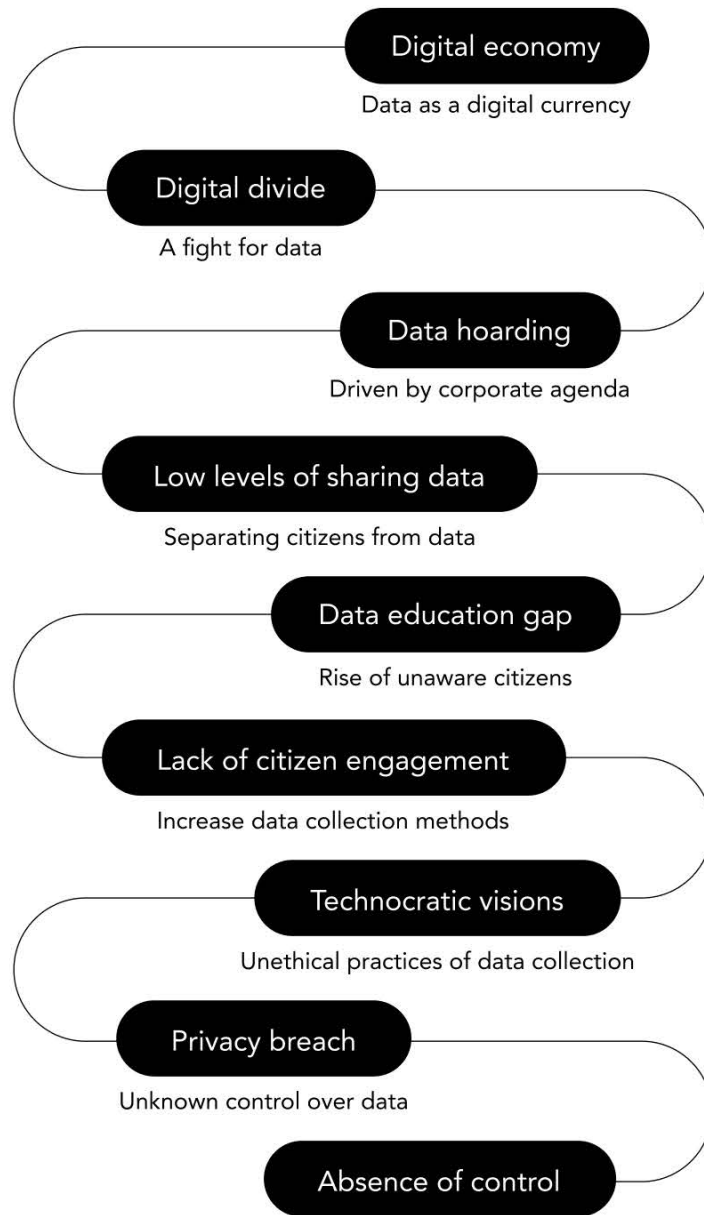


Fig 2: The effects and actions of the “Knowledge is Power” approach

With the notion of “Knowledge as Power” driving the system, Chafetz dives deeper into identifying the forces that drive the principles of such a system. She reiterates that the system understands the importance of data-driven knowledge in making decisions and so it treats data as a commodity that can be refined and exchanged for value. Such principles trigger data hoarding behavior

and support a knowledge economy: one with data imbalance and the lack of digital human rights (Chafetz 2021). The value of data comes from its ability to capture context and provide insights on user behavior. With majority of the urban population interacting over the internet, millions of data points are recorded each day. With societies dependent on technology, big data-driven economies now have the power to influence and affect social lives, and we may need to begin focusing on evolving and building our digital human rights. Rights that not only protect our privacy but also describe the importance of data in day-to-day life. This constitutes a current need.

The evolution of technology constantly delivers new ways to record, store and analyze data. This fuels technocratic visions and further draws blinders to the value that people can bring to the process of development. The lack of initiative to engage citizens in the conversation of data has created a Data Education Gap: a gap where users are unaware of what data is collected on them and how (Matthew Tenney, Renee Sieber 2016). This is a present-day problem which poses an opportunity to explore in the future. With people exposed to the broader conversation of data, they can truly understand the black boxes of the current system and explore new policies on data privacy and control.

Often on issues around data and digital privacy, people share their concern through comments, blogs, documentaries or even protests. The absence of a system where users can track and control what data is collected on them or how is it being used in following services and triggers, leaves people uninformed and helpless on where to begin. There is an untapped need for an official forum that manages data and the dialogues surrounding it.

As I explored future scenarios that could solve the current needs and problems, I reflect on the above learnings from e-Estonia and from Dr. Ann Cavoukian and Matti Siemiatycki, which consider key values to smart city

initiatives such as the incorporation of Privacy by Design within the system and keeping people at the front and centre of the initiative. Using this, I ideated on what a future smart city initiative for Toronto could look like.

Through the Literature Review, as I learnt about how companies practice a data-driven approach, I begin to understand that the collection of data is used to constantly gain deeper insights into the user's behaviour and context. This relationship between data and context got me to start thinking of an intervention where consumers could begin to understand the world of data through a portal that offers contextual information based on a user's profile and circumstances. And so, the design process explores what this intervention is, what form it takes, and what it looks like. This exercise helped me consider all the possibilities for how this intervention could come to life, from which I could begin narrowing down on the most accessible solution.

4.1.2 Converge

As I explored all the potentials, I repeatedly learnt that a major concern for citizens is to protect their privacy and to gain involvement in a smart city initiative. In response to the "Knowledge is Power" and 'technocratic' approach, this research explores the scenario of a smart city initiative in Toronto that invites citizens to an open data network with transparency and control. Along with a sense of data ownership, citizens can also learn to engage with live city data that may help guide and influence their experience of the city through an informed interface.

The idea of an open data initiative is to challenge traditional methods of managing data. It aims to distribute the power of data and change its Crown Copyright by acknowledging that all government data belongs to the citizens that generate it (Chafetz 2021). This would support a collaborative and participatory ecosystem. Giving citizens the control of their data would also

enable them to receive more contextual experiences, making it a more positive experience for them and a better use of company and government resources. However, the conflict in the value of data has slowed down the growth of the open data initiatives. While private sectors continue to hoard data, the Canadian government shares open data reports on an Open Government Portal. But in spite of those efforts, the government's idea of an open data portal is to only share data on past cases or scenarios, where decisions have already been made and the quality of data has grown irrelevant with time.

My research and exploration led me to a future scenario wherein the people of Toronto can begin to engage and control their own data. Further, it explores how such an approach might impart the right values to future smart city initiatives. And looking at data as public infrastructure, how might we also offer the value of data to those who generate it. Through an intervention, I hope to highlight the capabilities of data and encourage conversations on smart city initiatives that incorporate open data, data-driven participation, and most importantly a people-centric approach. For this reason, my design for a preferred future tackles the needs of a digital ecosystem, and the products that need to exist within it. Although the idea of controlling all data is a wicked problem, we can begin to explore ways to onboard people into the world of data. This process of materializing my intervention with the supporting infrastructure, teams and policies is explored in the final back casting stage.



5.0

Project and prototype

Reflecting on the earlier connection built between a person and a data point, I was interested in exploring the concept of "context". Each day in the form of data, the digital world records and documents the context of people which, when analyzed, gives them further insights into the profile of a person. Through a cumulation of data points from decisions, explorations, locations, click timings, likes, dislikes and various other interactions, the documentation of a person's context is what fills data with value.

5.1 Adaptive interfaces: An independent contextual experience

Inspired by the idea of context in digital experiences, I began my design exploration by looking for current examples of contextual experiences where technology is used to deliver contextual experiences. A contextual experience is one that aims to identify, classify and validate a user's needs in order to alter a suitable output that is relevant to the user in a particular context (Jill E. Stefaniak, Justin Sentz 2020). As I explore different themes of user contexts, such as geographical information or the time of day, I raised the following questions,

"How can a digital experience change to suit our needs at any point in time?"

"How can being aware of a person's context feed into their digital experience?"

"How do we go about understanding the context of a user while still being transparent?"

"How can users control and trigger contextual experiences for themselves?"

Reflecting on our daily digital interactions, I was able to point out a few scenarios where contextual experiences were available. Let's take the example of Spotify's Car View: a feature that simplified the app interface when connected over the car's Bluetooth setting. The interface would automatically change to only display playback controls, song titles and other relevant information (Schoon 2021). Its objective was to offer the user a simplified interface upon learning that

the user was going to be driving. While Car View aimed to assist users in a relevant moment, it received mixed feedback as some users were unhappy about the sudden change of the interface from what they were familiar with, and they also felt a lack of control since the feature was automatically enabled rather than one that users could opt in to.



Fig 3: Spotify Car View Interface



Fig 4: An Apple Watch contextual experience

A second example of adaptive interfaces in action is the case of an Apple Watch. The watch would learn of the user's movement and give them the choice to begin logging their walk or other form of exercise. What's different about this scenario is that the experience first presents the user with a choice, which portrays control and offers the option to opt into the feature. Apple provides another example of contextual experiences via its App Clips: users are guided to a specific function of an app when the need arises for it. For instance, App Clips will automatically recognize that I am at Time Square and looking for an experience. A pop-up automatically appears from the bottom of my screen, which presents a list of attractions I could visit. As a result, users do not need to open the app and navigate to this point by themselves.

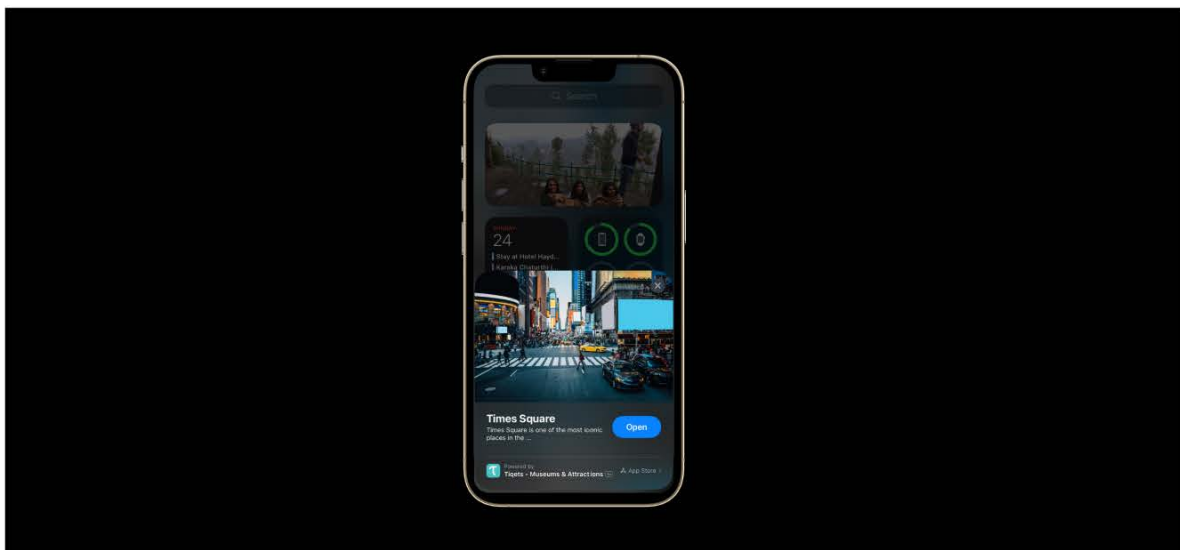


Fig 5: Apple App Clips context-base prompts

Another example of an inherent contextual experience is Google Maps. Leveraging the live data on a user's location, Google's algorithm provides search results that are physically located around the user. The idea of context recorded through data helps deliver tailored experiences to a user.

These cases are examples of how companies are trying to solve the same

current needs and problems. On observing such cases, it is apparent that the synergy between data and context feed into the level and details of an experience. It also illustrates that the use of a contextual strategy can help improve engagement and look to increase accessibility to experiences. However, users do not have complete control on how the interface reacts. Using pre-set templates based on criteria such as age or geography, different people have different experiences using them, such as with Spotify's Car view. While such efforts do work towards improving accessibility, they do not solve the problem of presenting users with control. Directly opting users into an interface change without their input or control may lead to even good ideas being turned down. A lack of control in such cases may be perceived as more frustrating and inconvenient rather than helpful.

Another key learning from the above case studies is that while apps do make the effort to design new contextual experiences, each experience is still confined to a single application and independent to other digital mannerisms of the user. As the idea of The Stack moves from a theory to reality, we can begin to think about a broader ecosystem of contextual experiences; an ecosystem that revolves around the user and offers a centralized link between applications.

5.2 Smart Identity: An ecosystem of contextual experiences

Building on the concept of individual experiences in independent applications, I then explore the idea of a centralized identity that allows users to build a common link between various digital touchpoints.

With applications and businesses working in silos, the digital footprint of a user gets scattered over the internet. I realized that in order for multiple contextual experiences to come together, a centralized link could be developed. One that could not only offer connectivity but also ownership and accountability of data to the user.

Using traditional design practices such as role playing, I explored what an idea culminating in contextual experiences could look like. Through a series of low-fidelity mock-ups, I used the idea of a centralized identity to trigger different experiences and interactions based on the needs and interests expressed by the user.

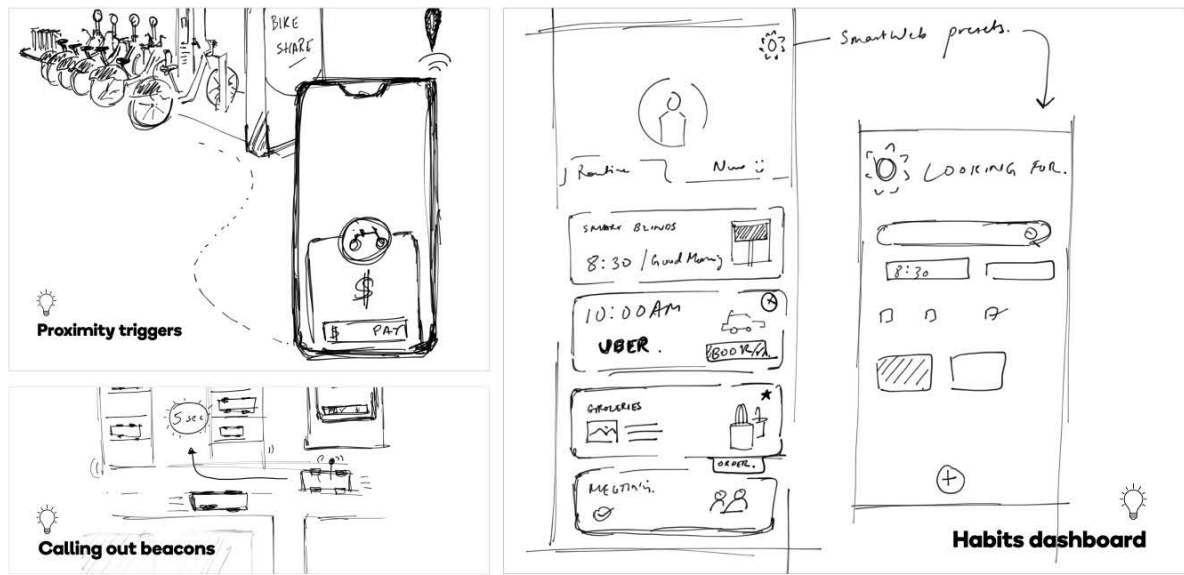


Fig 6: Brainstorming a centralized dashboard

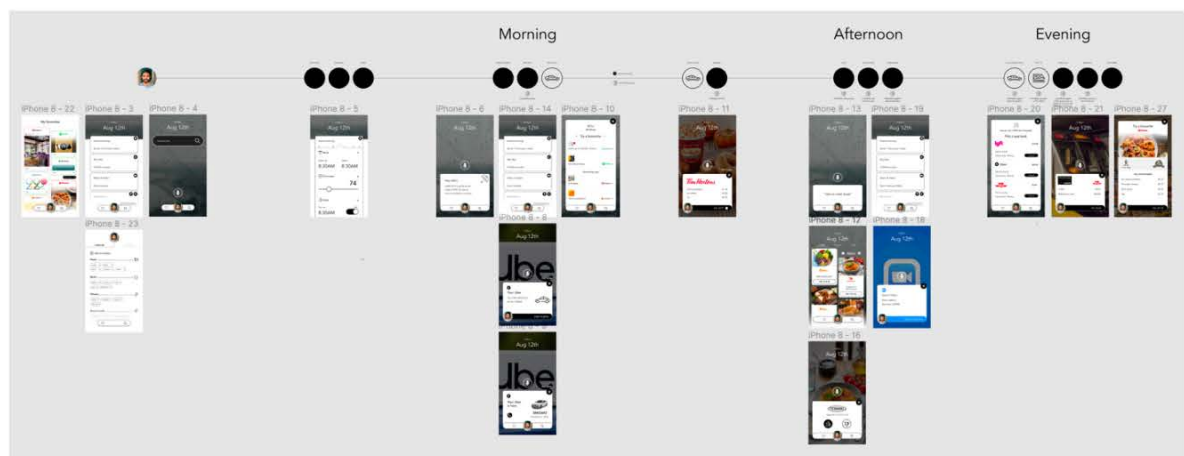


Fig 7: Low fidelity mock-up of a user journey in a digital ecosystem

Through experimenting with the concept of a smart identity, I wanted to explore how a digital interface could draw from a single identity. In order to put

together this series of contextual experiences, drawn from different sources, in one place, I realized the need for a centralized identity that would be visualized in a dashboard that would allow users to manage and experience their digital ecosystem while still being secure. With a centralized identity, people would have a more complete data profile of themselves which captures a series of datapoints that various apps and activities would collect on them. Needless to say, this is valuable information that can be misused in the wrong hands and could leave people at the mercy of profit-seeking corporations. This led me to think about anonymization, and how people could contribute to the city's public database in order to aid its development while still maintaining their privacy and anonymity. Finally, as I reflected on which interactions and activities would add value to the user's life, I realized that many of them were instances of the person interacting with the city and community. As a result, I began to consider how the city could play a greater role in this initiative, and how this project could give rise to a more accountable and transparent government.

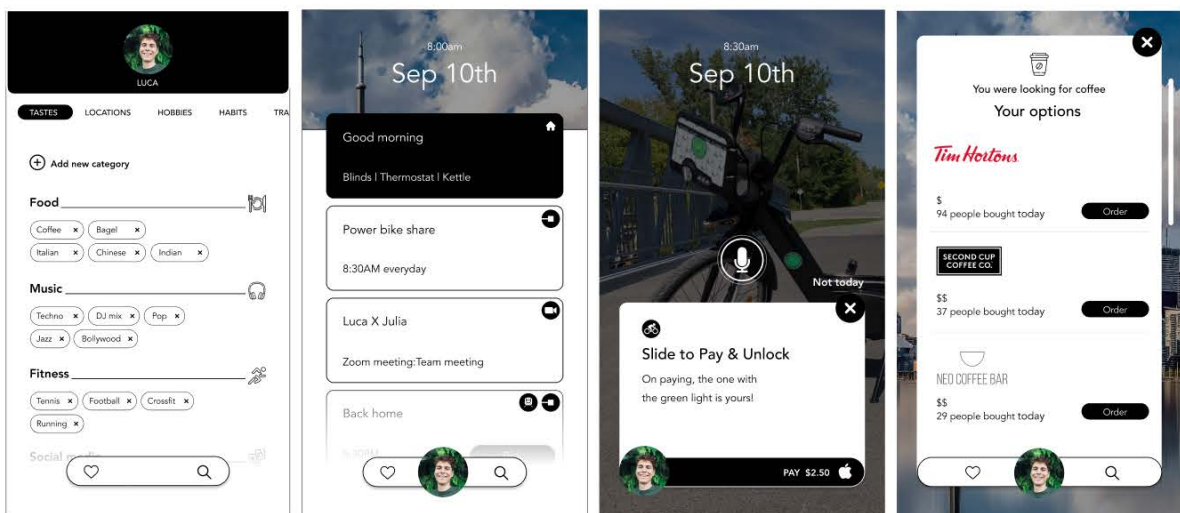


Fig 8: Exploration experiences and interfaces of smart identity

To summarize, as I explored the concept of a smart identity as a channel to deliver contextual experiences and a unified identity across various channels, I

learnt two key things: firstly, that a unified identity was effectively a digital identity – an anchor to all your interactions that you wish to control. Secondly, it became apparent that a lot of governance would be required for this to be effective, and meaningful interactions were happening more at a society level rather than at an individual level. This led me to envision a future scenario that was focused more on the city rather than individual experiences. For these reasons, I chose to explore the idea of citizens receiving a unique digital identity that is sponsored and managed by city governments. Finally, this prototyping exercise within my design exercise highlighted the lack of user-friendly visualization and control that people have to access their own data, as well as city-generated data.

5.3 E-Toronto: Open-data ecosystem for community engagement

Building off my learnings from the smart identity process, I began to consider the project at a social level and wanted to create a tangible platform where citizens could interact with city data and begin to understand and control their own. Following a “Knowledge is Power” approach has led to a digital divide and corporate greed, as organizations are trying to serve the same customers however there is no synergy in their efforts. A drawback of this present system is that people have different identities for different portals: a different taxpayer account, bank account, insurance provider, Uber account, and so on. However, these touchpoints don’t currently talk to one another. As a result, experiences exist in siloes and users are unaware of the wealth of their data created through their engagements. With user’s complete profiles scattered across numerous platforms, we have transitioned into a digital environment where users are not included in the conversation of data and are completely unaware of the movements and uses of the data that they have generated. This relates to concerns around privacy and protection, such as unethical and opaque methods of collecting data.

The idea behind my intervention is to begin the conversations of data amongst all citizens. With big data-driven decisions, data has the ability to influence our lives in conscious and subconscious ways. It dictates and informs much of what we consume, whether it's Instagram's explore algorithm, Amazon's recommendations or Netflix's strategy to create new content. And so, it is imperative that we begin to treat data as public infrastructure and insert more transparency.

To develop such a system, I began to dive deeper into the question – what if data became public infrastructure? Every digital touchpoint generates some data about you. The idea is for those different datapoints to come together in one place. To illustrate, we can draw a parallel to a bank account. Similar to how banks provide a space for us to digitally store our money, citizens could gain access to decentralized data vaults that contain their datapoints from different sources. This data is broken up into 2 categories: data that is accessed, and data that is generated. Accessed data refers to items that stay constant such as saved bank cards and personal data records. Generated data, on the other hand, is dynamic and real-time and captures information on consumer behaviour, preferences and decisions. Such as data generated by the content you view or web pages you access.

E-Toronto as a smart city initiative seeks to address and improve the generation, experience and engagement with both these data categories. It will do so in two ways: via a physical TO-Card, which onboards them to the smart city initiative, and via an E-Toronto mobile application that builds ongoing engagement with data.

5.3.1 TO-Card

I began to brainstorm what kind of platform would enable me to

incorporate all these learnings into one place. I found that the intervention needed to begin with officially onboarding citizens to a tangible card that allowed for daily engagement and interaction with city data. Each citizen will receive a unique digital identity in the form of a citizen data card. I have chosen to brand this as a 'TO-Card' to represent the initiative's Toronto focus and draw greater affinity between the citizens and the program. Each card will be associated with a unique identification number that acts as a digital identity. Like a Social Identity Number (SIN), the TO-Card will act as a unified digital identity to help instantly access services and benefits across the grid. Citizens will receive their TO-Cards through an in-person verification process conducted by government officials.

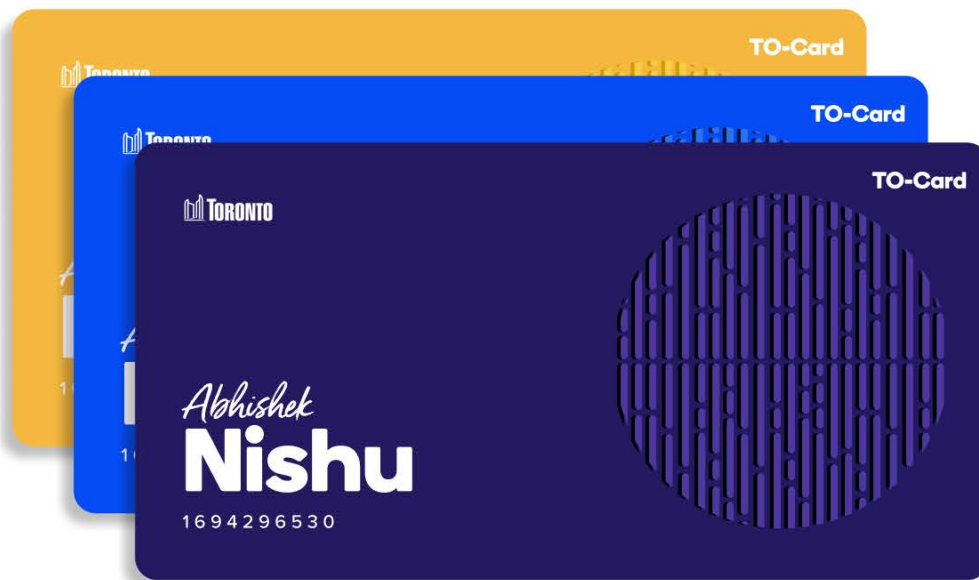


Fig 9: TO-Card Design

Next, it was important to examine the current flow of data in people's lives. As mentioned above, people interact daily with the flow of data in 2 key ways: the first is with accessing static data and the second is with generating new data. While addressing our needs in the city, digital touchpoints also exist beyond the reach of our smart devices. Touchpoints such as a Presto Card to use public

transit, or even accessing financial data such as mobile wallets to carry out transactions. Although the Apple Wallet provides a digital solution to manage data that we require at various physical touchpoints, such as saved credit cards, loyalty cards or vaccine passports, the feature does not lead to a unified digital identity. Everything remains independently accessible. However, a positive takeaway from this example is the ability to immediately access a piece of data as and when it is required. This is an instance of a contextual experience that is in the control of the user.

Reflecting on prior research conducted on citizen engagement, a key learning was identifying how most users still prefer traditional methods of interaction (Chafetz 2021). Despite technological developments, it is still important to look at how accessible and comfortable users are with digital tools. While the TO-Card can be accessed through your smart device in its digital form, there was also merit in providing a tangible, physical card. This offered better accessibility and gave users multiple mediums of engagement. A combination of physical and digital cards gives people the option to use whichever medium they are more comfortable with. This creates an inclusive opportunity for people that are afraid and uninformed of how to use technology, or people that choose to limit their digital interactions in a day. This also aligns with an underlying philosophy of the E-Toronto initiative, which is to serve people in the way that best suits them. Providing a physical and digital card combined also provides greater security and convenience in the event that one of them is lost or forgotten. As the TO-Card offers citizens a formal way to identify and position themselves in a new digital system, it is crucial that all citizens can have access to a physical card if they wish. Furthermore, given that it is a key piece of identity, having two forms of it will allow for greater verification and troubleshooting. For security purposes, however, a citizen's data is not stored on the TO-Card itself.

The TO-Card functions like a data broker for citizens to instantly access their decentralized pockets of data based on their context at any point in time.

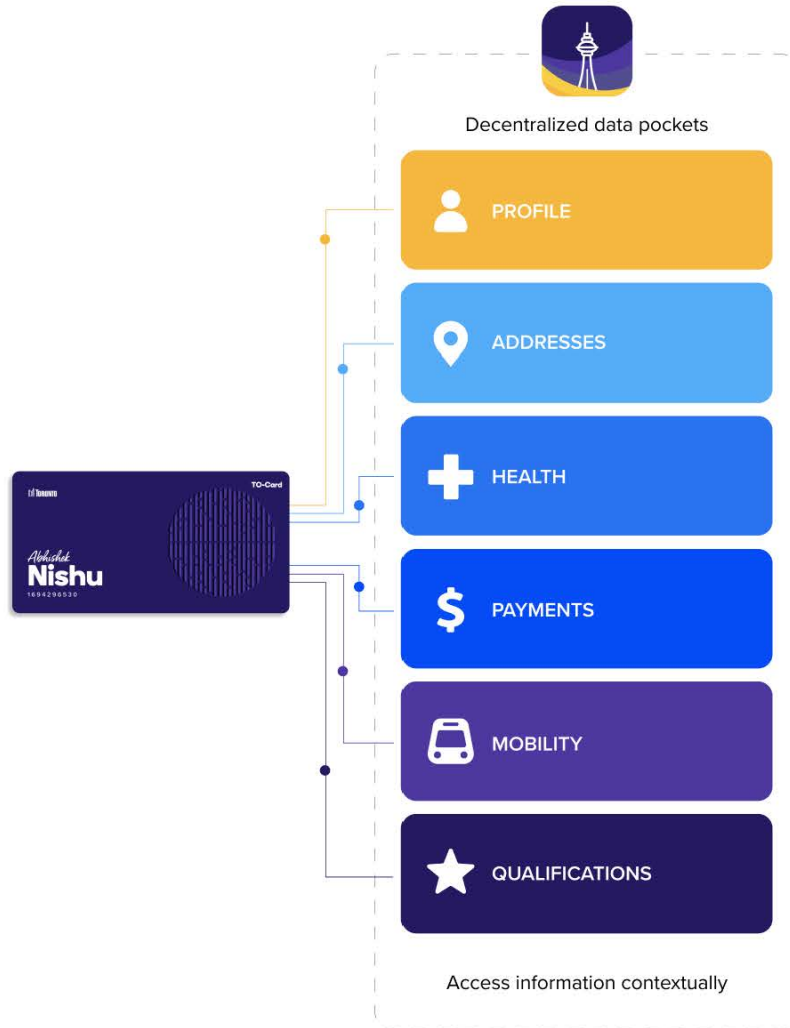


Fig 10: TO-Card decentralized pockets of static data

The above diagram displays how a TO-Card is connected to decentralized pockets of static data. As and when citizens require their data, a simple tap of the TO-Card will contextually draw the relevant data from the necessary pockets. This is possible as each TO-Card follows a standard coded format of data pockets. In order for businesses to acquire the right information from citizens to complete their service or transaction, the system includes an approval process by E-Toronto, where the business will request for a E-Toronto card reader programmed to pull the relevant information. This will be a standard process for all businesses to gain access to the TO-card feature. By integrating TO-Card transactions into their services, vendors gain the opportunity to offer seamless experiences to citizens.

Furthermore, the idea behind the TO-Card was to not only accumulate and organize a person's static data, but also to provide them with an official digital identity on the open data network, which is done via the mobile application.

5.3.2 E-Toronto mobile application

It was vital that E-Toronto took a digital form in addition to its physical TO-Card form, as it is not only accessible but also engaging. I use current smartphones as the instrument to deliver E-Toronto's digital interface. The CTA mention that around 86% of Canadians surveyed own a smartphone and while the remaining 34% plan on upgrading their device (Hardy 2018). With reference to this, Hardy also goes on to state that Ontario has around 89% of smartphone penetration. While these numbers validate the choice of leveraging smartphones as the medium for the design intervention, the medium also offers the advantage of familiarity and fluency amongst citizens. Newer technologies do offer the opportunity to create more engaging experiences, however it is important to reconcile that with the lag times and difficulties in the adoption of a new medium such as augmented or virtual reality.

The E-Toronto mobile application will be organized into 3 sections, The City Dashboard, the Digital Profile and the TO-Tracker

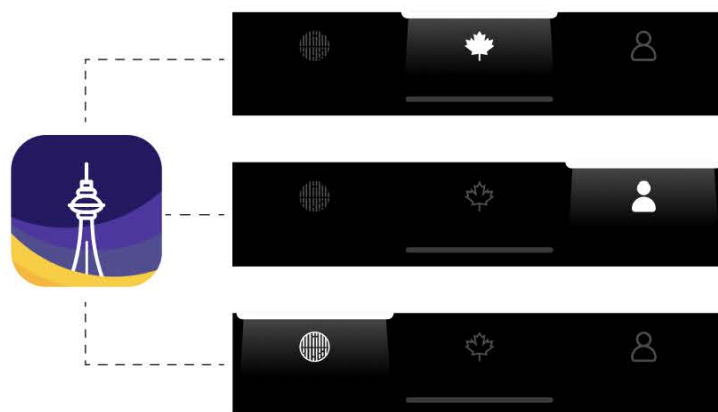


Fig 11: E-Toronto mobile application sections

Section 1: City Dashboard

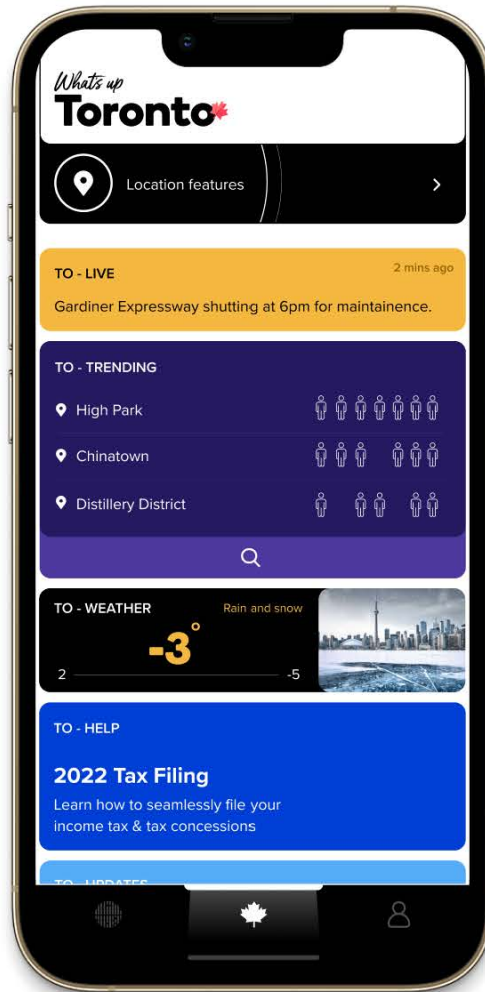


Fig 12: City Dashboard interface

The first is a City Dashboard that engages citizens with live city data and developments through a series of 'TO-segments'. These segments explore various ways of visualizing relevant data and enhancing one's experience and knowledge of the city. It further highlights the potential of sharing data on an ongoing basis. During the COVID-19 pandemic, the World Health Organization began to widely use the term "infodemic". An infodemic describes a situation when there is an abundance of information available on any given subject and it becomes difficult to differentiate the truth from misinformation or unreliable sources (Organization 2020). In the case of the pandemic, we noticed an

infodemic: with high levels of misinformation spreading, people began to feel anxious and overwhelmed, which made them unable to make decisions clearly. Although there were many drawbacks of the pandemic, being actively aware of the developments of the virus, vaccines and policies helped people navigate in a safe and well-informed manner. Similarly, I believe a City Dashboard could provide relevant and helpful information to citizens on an ongoing basis, which allows them to make informed decisions and make better use of the city's resources and database. The City Dashboard comprises of the following features:

1. Location Features

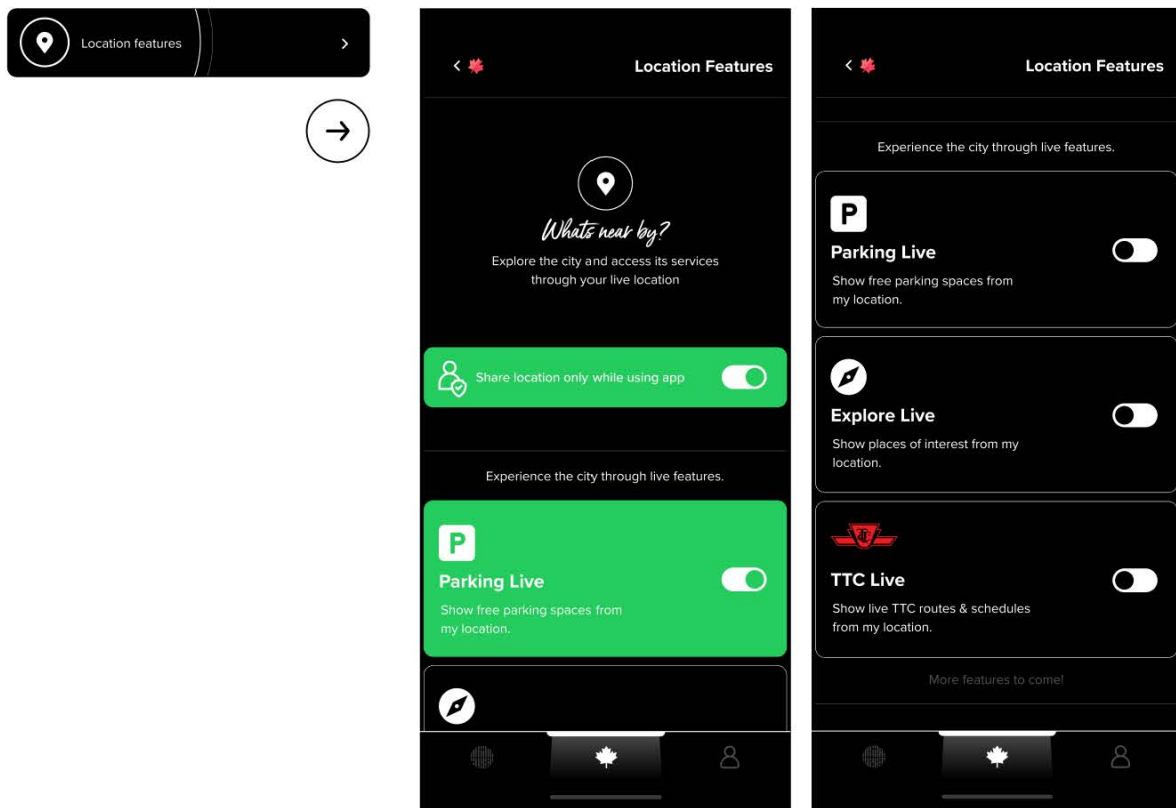


Fig 13: Location features interface

To support this feature, other existing technologies are required to work in tandem to further enhance the benefits of live location functionality. Through the adoption and evolution of smart sensors and iBeacons, a user's live location interacts with these technologies to provide recommendations and advice on

how to better navigate and experience the city. For instance, location services rely on these beacons to support citizens in finding helpful information they require around them, such as vacant parking spots and live TTC schedules.

2. TO-Live

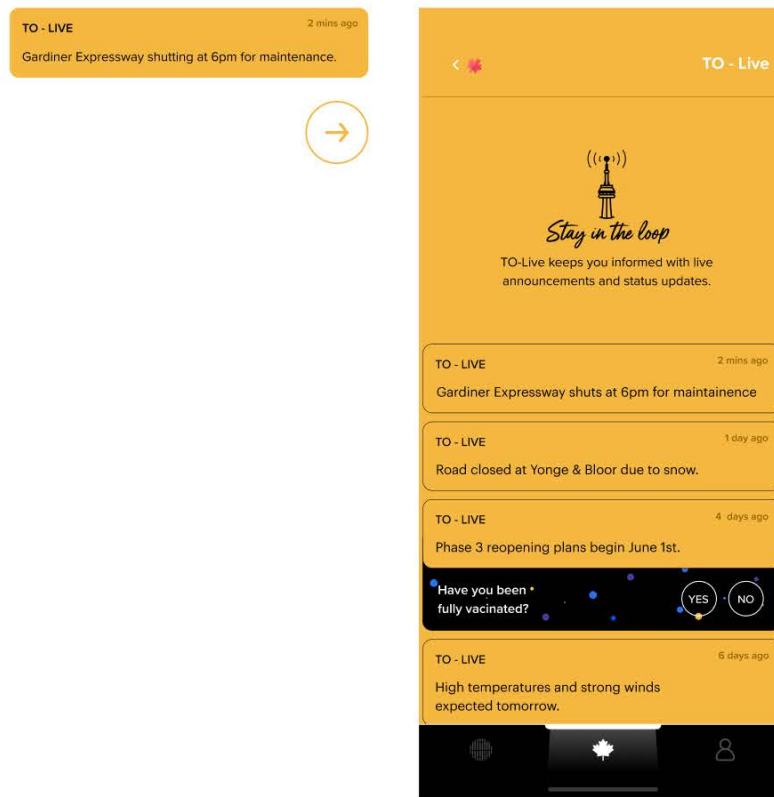


Fig 14: TO-Live interface

The interface explores how to share the benefits of real-time surveillance with people. This includes live data from traffic cameras or even updates in city policies, as the dashboard shares live information and temporary changes in the city. This pertains to updates such as roadblocks, heavy traffic zones, maintenance-induced closures and even dynamic changes driven by weather conditions. Changes in a city's social policies, such as evolving COVID regulations, will also be included as live updates.

3. TO-Trending

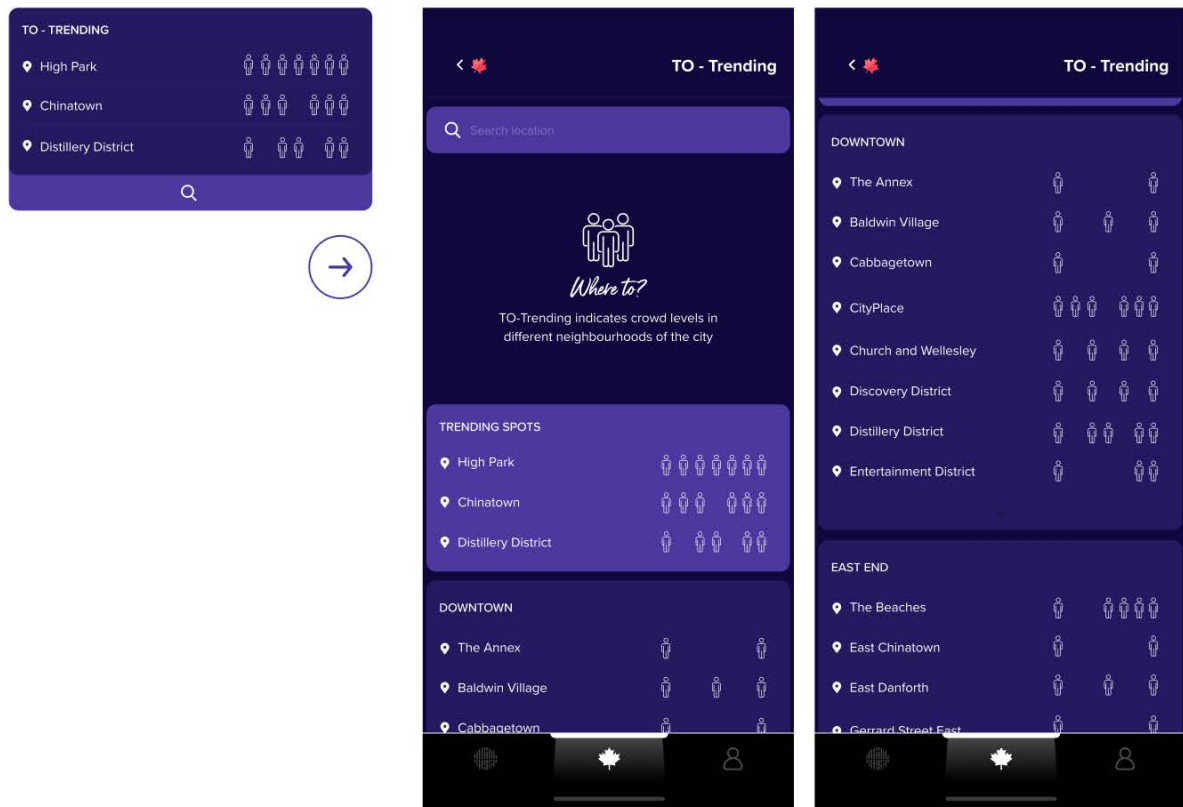


Fig 15: TO-Trending interface

The TO-Trending feature is a density tracking tool that allows individuals to gauge how populated a given neighbourhood or location is. Through anonymous location sensing, this feature captures high-traffic zones such as parks or entertainment districts and gives people the option to choose whether this aligns with their interests and requirements of an area. For instance, a densely populated neighbourhood may not appeal to a person that is averse to crowds or running on a tight schedule. Conversely, a busy neighbourhood may signal activity and excitement for those seeking that. The interface describes a higher density with figures closely placed to one another, and lower density with figures that are more spaced out.

4. TO-Weather

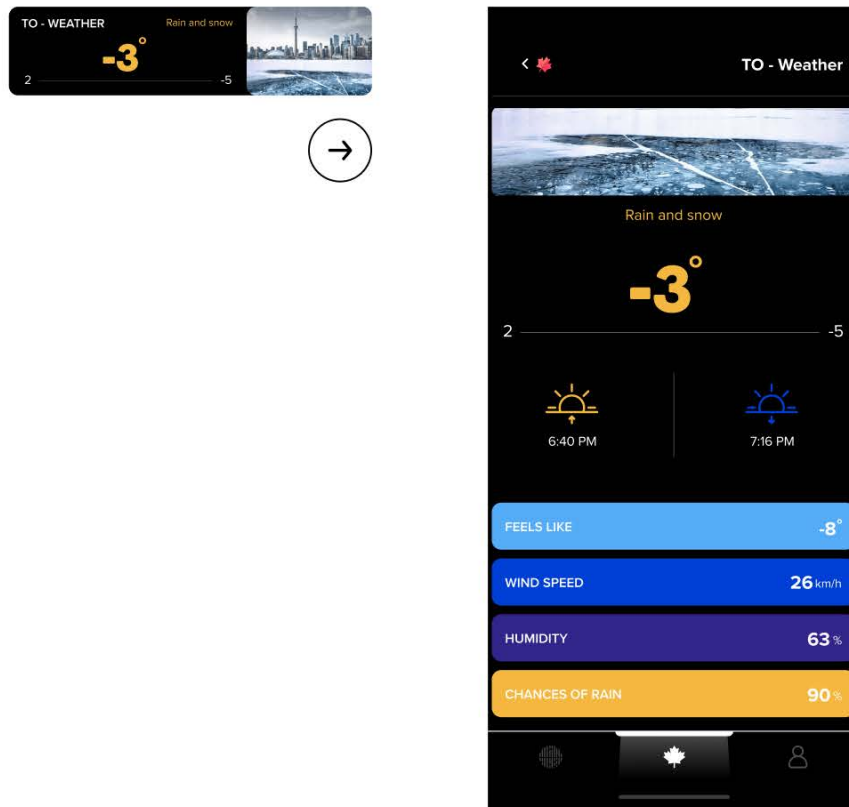


Fig 16: TO-Weather interface

While weather is a common feature that is already embedded into smartphones today, it adds to the context of an environment and allows users to gain all the relevant information about the city in one place. Over time, as data becomes richer, this feature can evolve to promote weather-related activities such as ice skating or cherry blossom viewing.

5. TO-Help

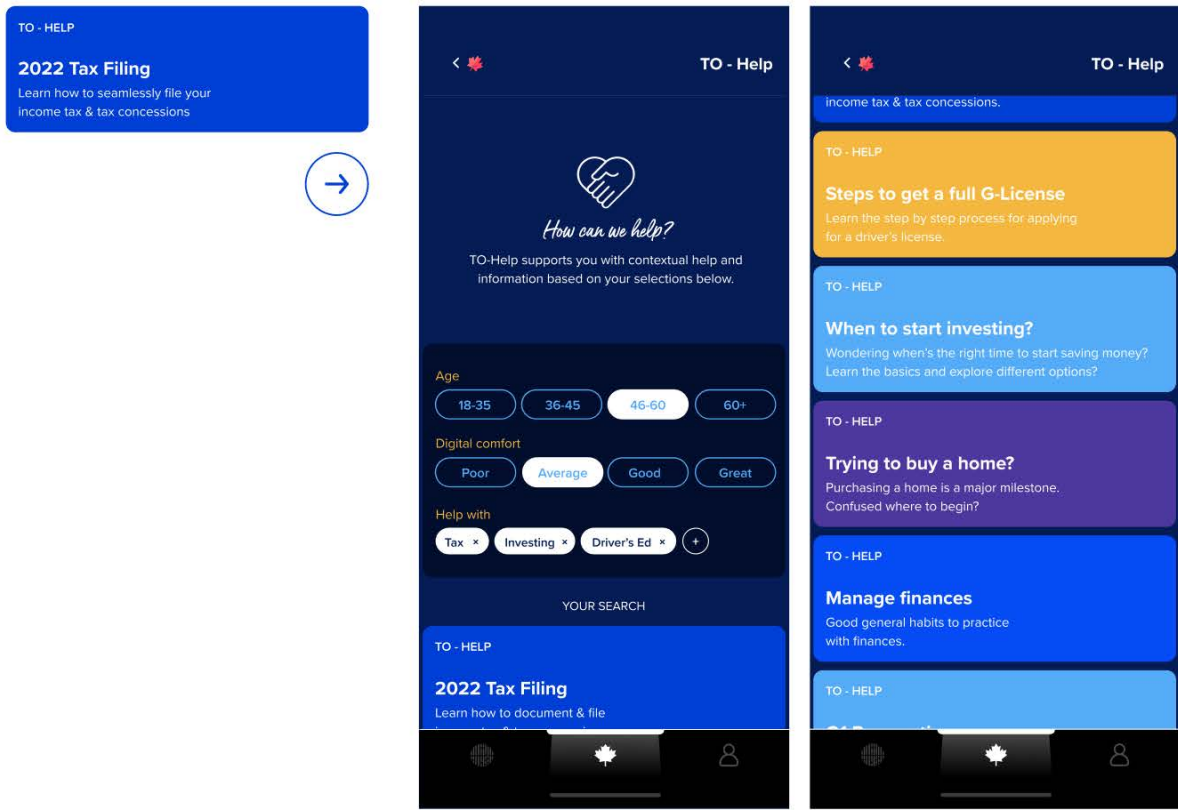


Fig 17: TO-Help interface

TO-Help is inspired by the idea of contextual learning as it relates to one's unique life circumstances and accordingly provides relevant information. As the example above indicates, users can indicate their age, digital comfort levels, and the areas in which they need help. Based on their selections, they are prompted with relevant information from existing databases. As such, this data seeks to make existing data useful and accessible as well, such as how to file taxes or how to apply for a driver's license.

6. TO-Updates

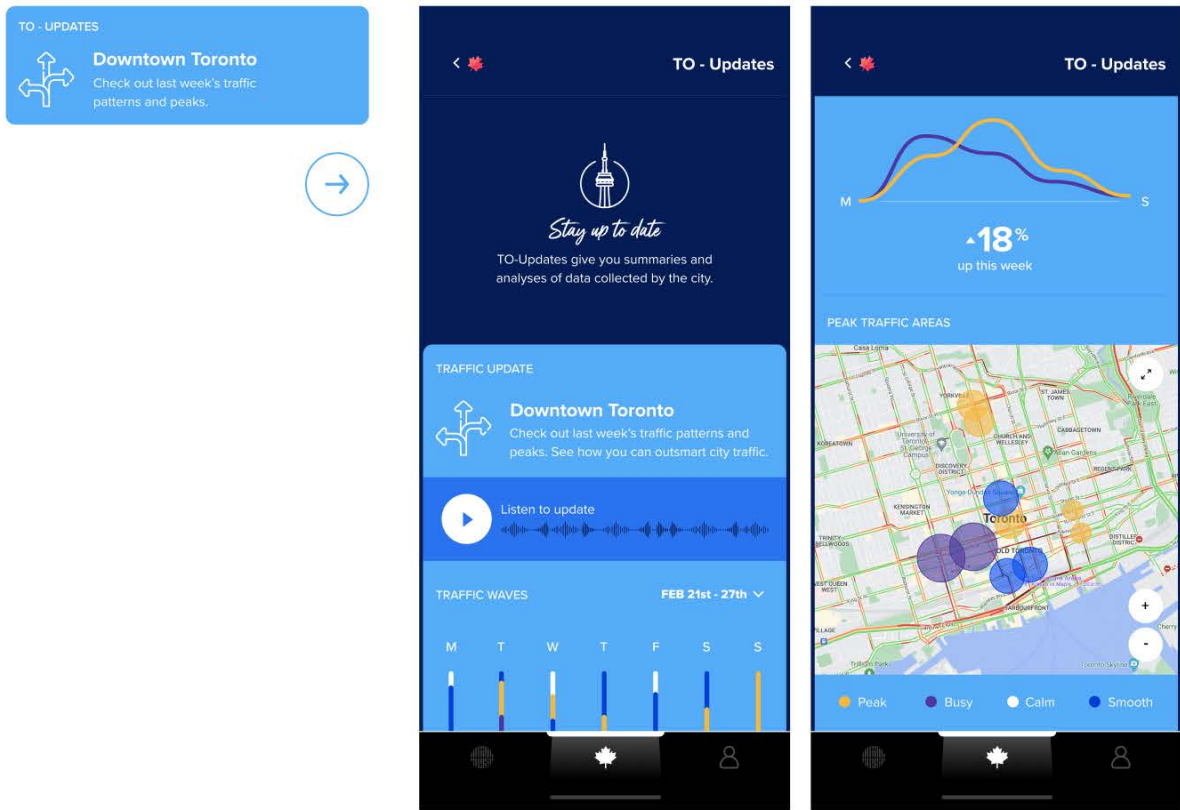


Fig 18: TO-Updates interface

The collection of data through smart sensors, user-generated content, surveillance measures and various digital interactions lets the city understand different categories in detail, such as transport, healthcare, or utilities. This could include traffic and transit data for any given location. By analysing collected data, cities hope to improve and build upon existing systems that provide periodic reports (e.g., weekly) that can inform people's choices and actions. Analysis of this data can highlight points such as peak traffic timings, and citizens can choose to alter their schedules accordingly. The use of TO-Updates can help the platform engage citizens with data that is visualized and presented along with a brief analysis.

7. TO-Events

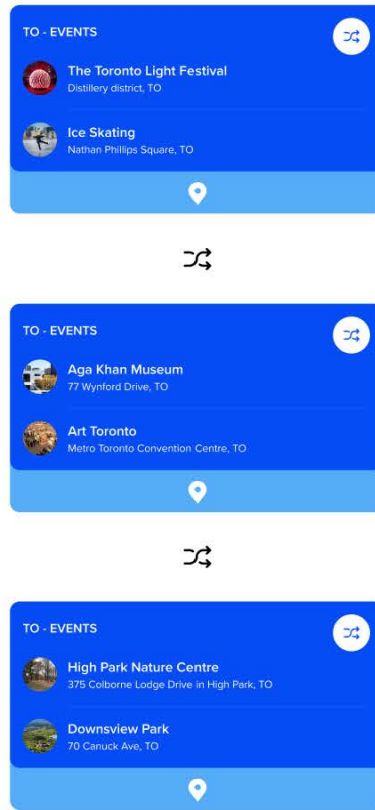


Fig 19: TO-Events shuffle feature

TO-Events is a way for citizens to gauge what's happening around them, and to make the most of what the city has to offer. The suggestions are provided based on the user's live location and Digital Profile.

8. TO-New

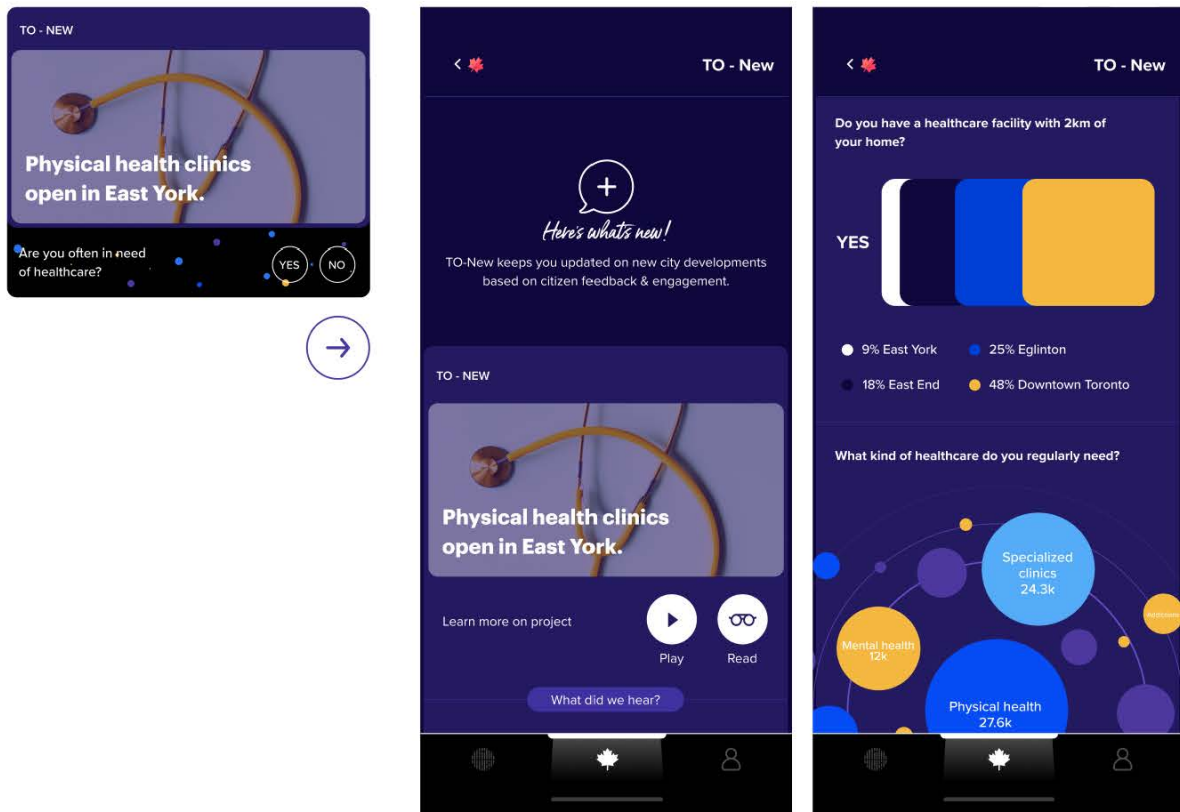


Fig 20: TO-New interface

This feature is a way to inform people of the city's learnings and subsequent initiatives from the open data network. Through this feature, the city informs citizens of new developments that were made based on the collective responses to quick polls that are conducted on the dashboard. This relates to things such as the opening of new businesses and restaurants, and the introduction of new infrastructure such as roads or parks.

9. TO-Thinking

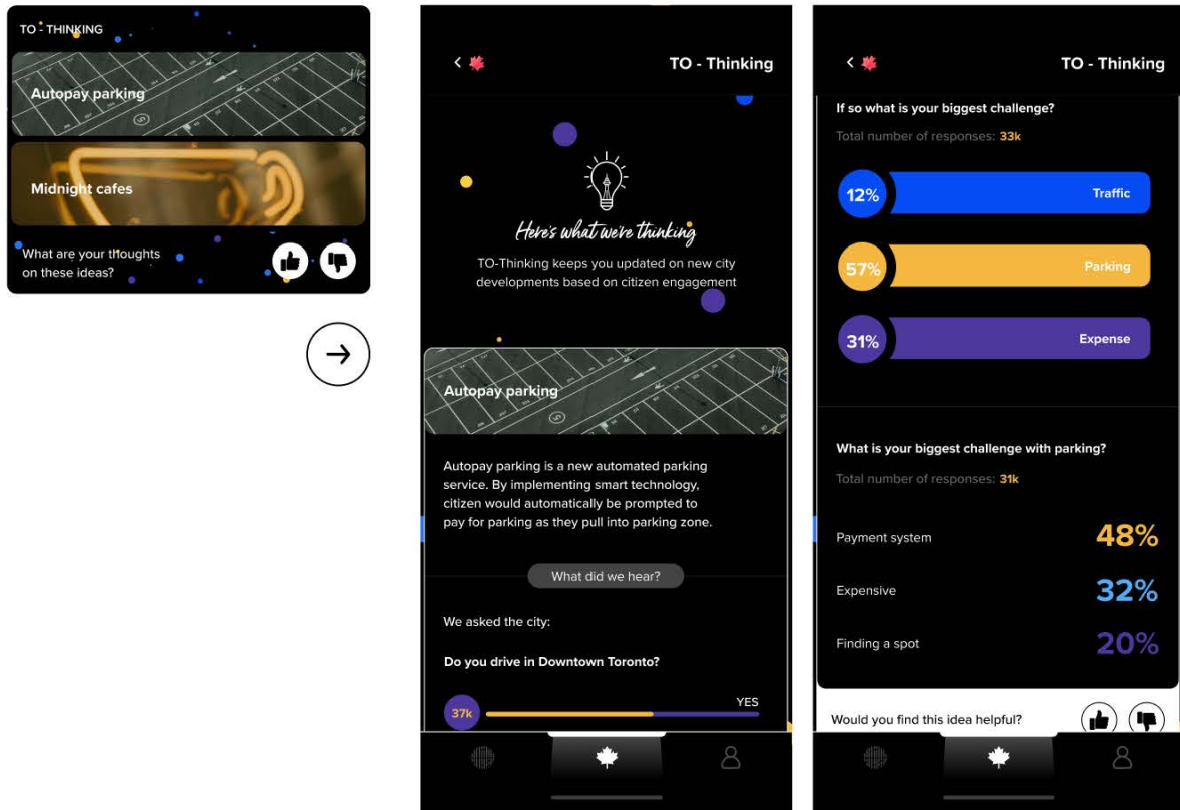


Fig 21: TO-Thinking interface

With the city gathering and sharing large amounts of data, the interface also allows for short polls to gather citizen feedback and acts as a channel for data-driven participation. Responses to such polls can inform aspects such as future developments and policies that impact people of a particular neighbourhood or even the city at large. These polls can be added into various TO segments if they are relevant, or else they can exist on their own to capture and validate the city's understanding of people's needs. The city's analysis of this data can give rise to new business ideas or developments, and the ideas that are eventually implemented will be shared in the TO-New section as mentioned above. TO-Thinking is powered by responses to polls, as well as by anonymously shared data profiles of people from the city. This will be addressed in the section below. Through E-Toronto, the city engages citizens with live data and builds a

communication bridge between citizens and the local government. Leveraging this connection, governments can better understand the needs of citizens and include them in the process of new developments and models.

Section 2: Digital Profile

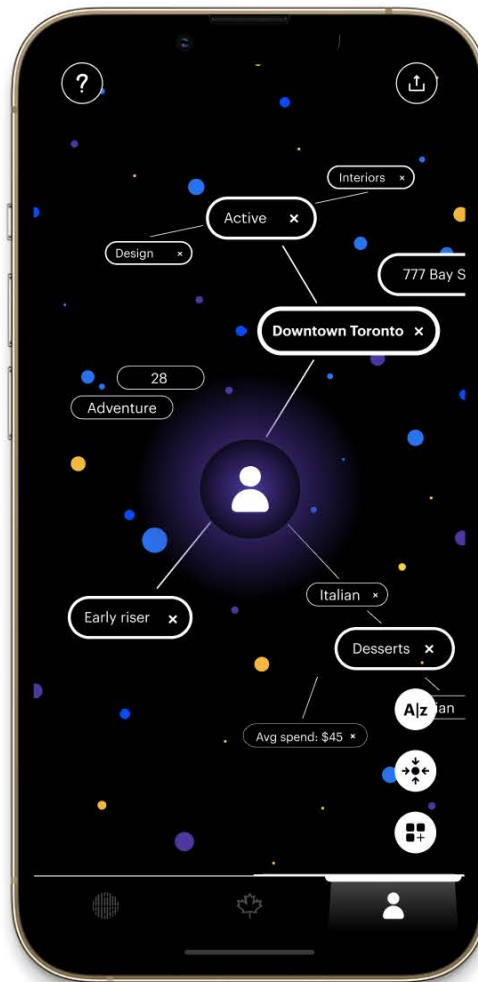


Fig 22: Digital profile interface

As mentioned above, the TO-card helps you access your static data in different scenarios. This pertains to the data pockets linked to your TO-Card such as financial data, medical records, profile details, saved addresses and more. In

the Digital Profile section of the application, users can control all data on them, being the information within their data pockets and the constant data that they generate through various interactions with other applications on their smartphones.

On joining E-Toronto for the first time, citizens will be required to carry out a one-time set up of their data pockets. This includes inputting relevant information that they wish to routinely access. While each of these data pockets will be decentralized and stored, citizens will still have instant access to editing this data at any point.

Further building on the city's efforts to make data more open and transparent, all businesses will be required to be transparent and share the data that they collect on their customers. Unlike current open data initiatives that share raw data online, the objective is to present the data to citizens in a form that is easily consumable. Just as applications need to adhere to requirements of the App Store and Play Store before releasing an app on their platforms, E-Toronto will similarly provide a transparency framework for all applications to follow in order to function on the grid in a licensed fashion. On complying to the set framework, the Digital Profile section will offer users the chance to build links between existing applications on their phones to their E-Toronto Digital Profile. On creating a link, users will be able to see what data is collected on them and what associations were made based on their digital engagements. The data will present itself in the form of bubbles that are populated with keywords, which would be linked to a user's unified Digital Profile.

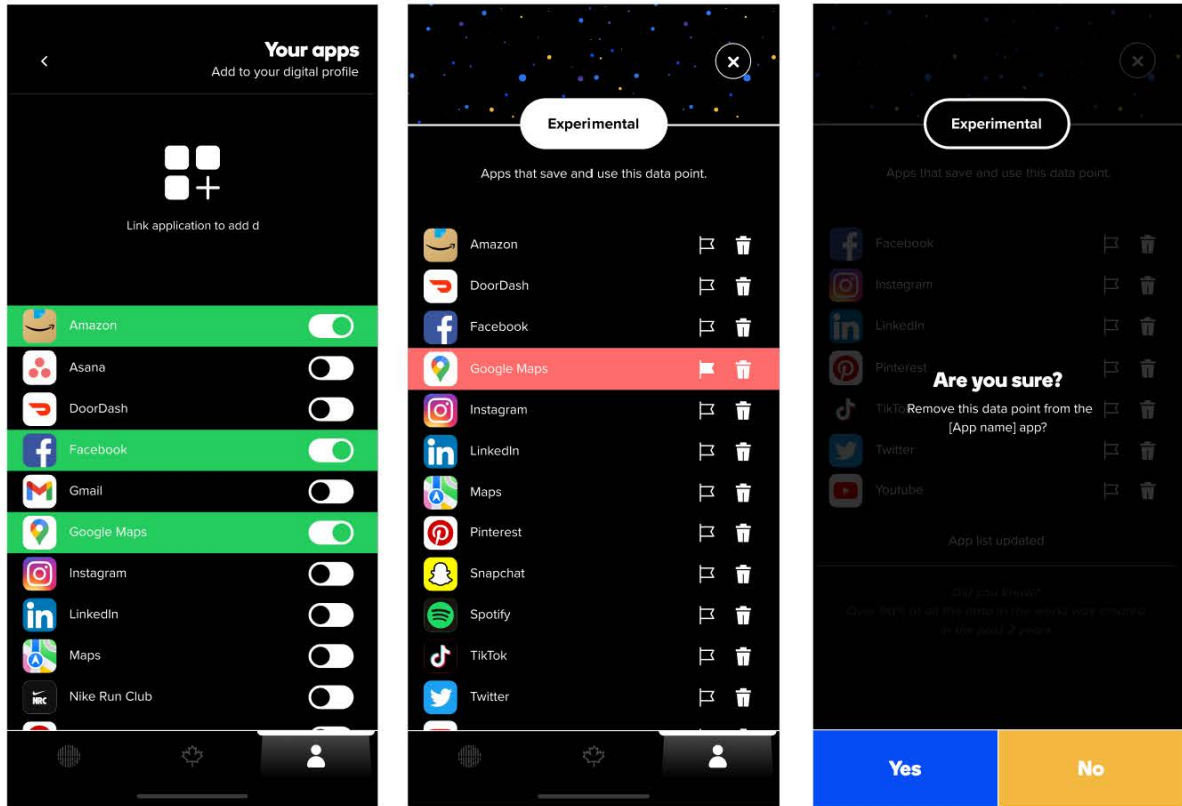


Fig 23: Building and controlling the Digital Profile

Through this experience, users can begin to tangibly process all the data that is collected on them. By clicking on a keyword, the app would present the list of applications that associate that particular keyword with that user's profile. The visibility and extent of data collection from various applications can help people make decisions on which apps they want to continue to use. If they believe that an application is intrusive and invading their privacy, the user could simply alert E-Toronto by flagging the application for malpractices, or the user could go one step further and stop using the platforms based on their personal values. Further, through consolidated reports, users are made more aware of the apps that promote privacy in contrast with others. This reduces the need for fine print.

The other aspect of control is reflected by the user's ability to edit their data profiles. If an individual is uncomfortable or unsure of a data point that has been

generated on them, they can remove that association from their profile as though it is one of many 'tags'. And finally, another use case of such a user-data interface is to explore how access to such personal and city data can influence the choices and decisions that people make in their lives going forward. Would people make more intentional choices based on what the data says about them, by either actively reinforcing or contradicting the tags that pertain to them?

While the City Dashboard engages citizens with live data on the city, the Digital Profile looks to provide control and build more contextual experiences. By linking applications to the open data network, users gain insights into current profile associations that applications have stored on them based on their usage and activity. At present, each application captures different metrics that are available to them. Currently, this is collected in four categories: personal data, engagement data, behavioural data and attitudinal data (Freedman 2021). Personal data refers to personally identifiable information such as SIN, gender, location and age. Engagement data captures the way in which a person interacts with a digital interface, such as how long they spend on pages or what they click on. Behavioural data adds a layer of insight which captures interests and preferences, and attitudinal data looks at metrics such as satisfaction. While this lends to rich data generated by a user, the user in question has no control over what is captured and what is analysed of it.

The Digital Profile solves for this by allowing users to see what data is collected across all the above categories by a single app. With access to their data profiles generated by other applications, people can then pick and choose which data points they want to include in their holistic Digital Profile. This is a consolidated profile of data points pulled from various sources to create a more complete representation of a user. Having created a data profile that they can better associate with, the user can then choose to anonymously publish this curated data profile, which subsequently gets sent to the city council and all participating applications that the user has linked to their profile. The city

benefits from this as it gains a better understanding of what citizens want and can create solutions accordingly. The companies benefit from this as they gain richer data about their users across all linked applications in exchange for sharing data that they themselves collect and share. This allows them to create targeted contextual experiences that users will be receptive to, thus becoming a more effective use of their resources. Access to these contextual experiences act as motivation for the user to voluntarily share their data profiles. On sharing their profiles, services can offer more tailored experiences based on the keywords and needs set by the user. If users do not link a particular app with their Digital Profile because they believe it infringes on their privacy or their beliefs, then that company does not gain access to the consolidated Digital Profile of that user and all other users that share this view. This way, there is an incentive for companies to act ethically and respect the privacy norms that the community collectively dictates as acceptable. If companies ignore these norms, they lose access to valuable data that translate to business opportunities for them. Between the company losing linkages from many users, and the council receiving many reports against the company, the company will be forced to change their ways or be removed from the system.

Section 3: TO-Tracker



Fig 24: TO-Tracker interface

While the City Dashboard engages citizens with city data and the Digital Profile helps citizens control their data, the final tab is the TO-Tracker. This helps citizens track and log all their TO-Card activity. Like a bank account statement, the interface gives the user a log of all their transactions. Through various digital interactions in the city, the tracker will also provide transparency into what data is accessed at a particular digital touchpoint. Although the card is introduced as a physical intervention, the tracker also includes a virtual version of the card. Similar to the Apple Wallet, a virtual version of the card exists within this tab so that the

TO-Card can be accessed directly through the smartphone. It is important to state that the physical version of the TO-Card is still integral to onboarding citizens to the smart city initiative, but also to provide a version that is accessible to those who may be less comfortable with technology.

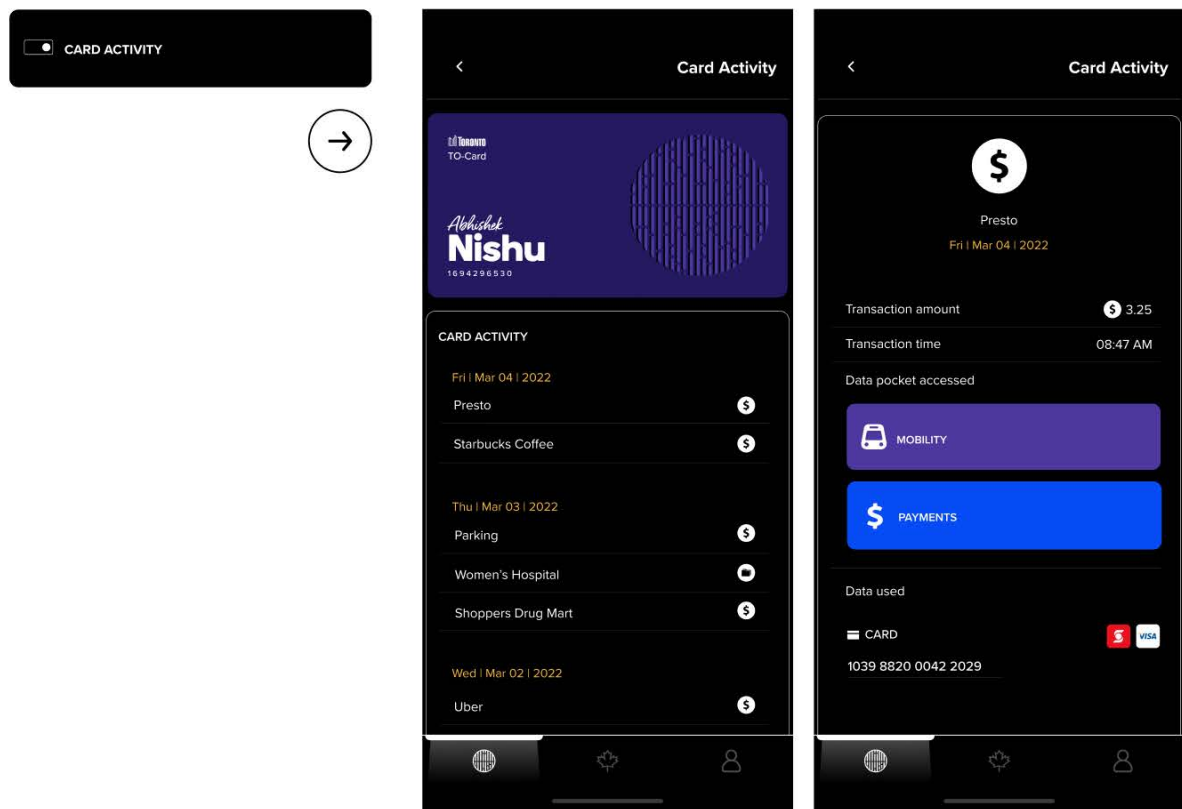


Fig 25: TO-Tracker experience

5.3.3 Summary

Consolidating the features of the application which include the City Dashboard, the Digital Profile and the TO-Tracker, this prototype aims to weave data into our day-to-day lives. The City Dashboard gives people ready access to city data while finding ways to engage people with the data that they are generating. It also creates data-driven participation, which supports contextual urban development. While this aspect initiates a conversation around data and how it can be used to benefit citizens, it also provides an official digital identity,

returns control to users, and creates transparency in the city's digital ecosystem.

Given this thought process, I look to back cast a strategy that would allow us to understand how this initiative can take place step-by-step, and what kind of policies and infrastructure is needed to materialize this program.



6.0

Backcasting a vision

After establishing the need for a smart city initiative like E-Toronto, which takes the form of a physical card and a mobile application, I back cast the requirements needed to begin materializing this idea in our world today. These requirements relate to the infrastructure needed to support the grid in Toronto, policies that prioritize and protect citizens, and teams to monitor and design the data that is generated.

6.1 The City Dashboard

Looking at the flow of data, there are 3 stages that surface: collecting, analysing and sharing. In my back casting for the City Dashboard, I organize the requirements as per these 3 stages.

Collecting

Starting with infrastructure, we would need to build a mature digital environment. This includes implementing technologies such as iBeacons and smart sensors, live location tracking, surveillance cameras and protection mechanisms, which power many of the features that can be found in the City Dashboard. The second big question to consider is where data will be stored, and how it can be stored safely. With the evident growth of the internet, the world is beginning to understand the value of growing the grid in a sustainable fashion. Therefore, the city can leverage organizations like Switch that run data farms entirely on renewable and green energy in order to store its data (Vision 2020). Switch currently powers farms for many significant technological players, from Tesla to AT&T, which reinforces its reliability and performance standards. Finally, the remaining infrastructure needed at this stage is to create partnerships between E-Toronto's platform and other bodies within the city and country such as the weather department and the CRA, for instance. These integrations help citizens view all the relevant city data and services in one place.

At a policy level, I consider people's potential hesitation with constantly sharing their live location and must ideate on policies that make them more comfortable with this. I invoke Ann Cavoukian's principles of Privacy by Design here, specifically Privacy as a Default Setting. Citizens should have the opportunity to opt-in rather than having the platform decide for them.

Finally, I address the need for different teams in order to facilitate the collection of data for the City Dashboard. At a base level, the E-Toronto initiative will engage with partners from universities rather than corporates. This keeps the initiative local, while prioritizing the people of the city rather than pushing a corporate agenda. This body will comprise the TO-Thinking team, which is responsible for ideating the ways in which to apply the city's needs as mentioned above. Accordingly, the team will also be responsible for understanding what data is important to capture for the development of the city, and therefore what polls would be valuable to launch.

Analysing

The true value of data lies in its analysis rather than its collection alone. In this stage, data is extracted and converted from its raw form to its communicable form. From a policy standpoint, data must be protected in both forms. Policies must also be enforced for how this data is treated in terms of who analyzes it, how they are elected and how it can be safe from human bias. With these policies in place, the team's responsibilities will be to make sense of the data that is collected and to present insights for the public through the TO-Thinking segment. The objective is to validate their learnings and gauge a response to potential new developments from the citizens. If citizens are in favour of a certain idea, the ideas enter a pipeline for execution. Upon execution, the outcomes are shared via the TO-New segment to indicate the city's attention to citizens' needs. Finally, a team will be tasked with creating backend tags in order to provide a contextual learning experience covered in the TO-Help segment.

Sharing

On extracting the value of data, it is important to make it accessible. Here is where a design and communications team would play a key role in visualizing the data in a user-friendly manner. It should not only convey the value of the data but should also create an engaging experience that invites people to participate. This leads to the policy consideration, which is to find a way to incentivize users to participate and share their data on the platform.

6.2 Digital Profile

I now look into the infrastructure, policy and team requirements needed to create a unified system that offers citizens control over the data that they generate through various applications on their smartphones. Starting with the policy, I go beyond the basic considerations of compliance and privacy regulations to additionally consider a policy that requires companies on the grid to share data collected on users in a format that is compatible with the E-Toronto interface. As mentioned earlier, this data will be shared in the form of keywords and associations. Furthermore, I also question how to incentivize companies to join and sustain such a system. By cooperating, companies gain access to a fuller data profile which presents greater opportunities for their businesses. The policy will also cover the need for a digital infrastructure that offers data sharing links to be established between apps and E-Toronto. Considering data as a public infrastructure, citizens will be given databanks to build and store their profiles. These profiles will be hosted by data centres as mentioned previously. Blockchain will play a key role in mounting the defence of these data centres. Finally, a team will be required to conceptualize the standard data sharing format for businesses, as well as to monitor company behaviour and flagging activity by citizens which indicates malpractices and ethical breaches.

6.3 TO-Card & Tracker

Lastly, I look at the policies, infrastructure and team that could support the implementation of the TO-Card in a physical and digital capacity. I begin with the basic policy of an in-person verification that is required to obtain a TO-Card. In order for citizens to use the TO-Card across various services, policies will need to enforce the adoption of programmed card readers across vendors. This leads to an infrastructure requirement of designing these machines to capture relevant data from the decentralized data pockets. In order for businesses to carry out transactions through the TO-Card, they would need to request E-Toronto for a programmed card reader that could pull the required information. Using the standard data collection format mentioned earlier, businesses must submit a request for what data they wish to pull at the time of transaction. This ranges from pulling financial information for purchases or submitting general profile information to complete an onboarding process. The city can determine whether to grant this access and will accordingly program that business' machine to draw the relevant data. Each reader will also offer a secondary layer of security by way of fingerprint scans, passcode or facial recognition to successfully complete the transaction. With readers programmed this way, citizens can access services instantly via a seamless and secure experience. As mentioned above, this information will be stored in the city's data facilities and will require teams to provide high levels of security and protection. With the city's citizens and companies equally invested in a system, the smart city initiative must consider security of utmost importance.



7.0

Conclusion

In conclusion, I revisit my research question to summarize my learnings and progress through the duration of this thesis project. My research question is as follows:

By treating data as public infrastructure, how can the city of Toronto understand the capabilities of open data, encourage data driven participation and provide greater transparency & control to its citizens?

From my Literature Review and assessment of current problems and needs, the absence of a human-centric approach when it comes to data became apparent, and how and why we use it. As we consider data as a public infrastructure, I found that there were merits of moving away from a “Knowledge is Power” model, which also takes us further away from corporate greed as it exists today. In order for an initiative like this to be successful, it needs to be pioneered at a city level rather than by corporates.

By choosing Toronto as my starting point, I was able to leverage the learnings from the Harbourfront Project by Sidewalk Labs, the Intelligent Community initiative, and the fact that an open data network already exists. This has created an ongoing dialogue within the city however these projects have failed for different reasons, whether it’s due to adopting a technocratic approach or failing to engage citizens. Therefore, envisioning an effective open data portal for Toronto involved prioritizing practices like better data visualization, which in turn leads to increased data-driven participation. By engaging citizens with open city data, urban development can become more informed and hence more relevant. And by providing a Digital Profile, the city extends its open data initiative beyond just city data and into the realm of other data generated across other digital applications. Similar to contextual urban developments, E-Toronto further presents the opportunity for contextual experiences through the city. In both cases, it is important to promote data-driven participation to engage citizens in the right context such that they understand the value of data.

Through the exploration, I also found that privacy as a concern extended across various digital platforms. As more businesses and services go digital, user-generated data grows as an invisible commodity. By introducing a unified identity and offering users a tangible medium, E-Toronto helps them control this invisible commodity and shine more light on backend activities. Subsequently, this will help address issues such as the data education gap and build data literacy and help manage privacy concerns. A tangible portal like this also helps the government grow an open data network and engage the community with data in a contextual manner. As data becomes more relevant to citizens, the objective is to encourage talks around the management and potentials of data.

Although the thesis primarily focuses on the relationship between data and citizens by presenting data in a more tangible and engaging manner, the research also highlights the value & importance of all stakeholders within the ecosystem. That is the citizens, government, and businesses. Having taken on an ambitious topic like data in today's days and age, the thesis aims to move forward into further research and reflections that look into the management and responsibilities that surround a complete data cycle. By digging deeper into the flow of data, we can begin to address surrounding issues of ethics and power across all other stakeholders.

By practicing the right values & principles, we can begin to foresee smart cities being more human-centric than technocratic. After all, the power of data should reside in the hands of those who generate it, while building accountability, privacy, and engagement.



8.0

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